

CHanging
Prior**IT**ies

3rd VIBRARCH

NOVEMBER 9-11, 2022

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CHanging PrioRiTies

3rd VIBRARCH

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Ivan Cabrera i Fausto

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INTRODUCTION

CHANGING PRIORITIES

Ivan Cabrera i Fausto

Conference Chair

Higher Technical School of Architecture of the Polytechnic University of Valencia, Spain

The 2010s constituted a fruitful decade for architectural research. From one hand, it was undoubtedly the time when almost all institutions devoted to the teaching of architecture managed to mobilize a fair percentage of their teaching staff in terms of research. Only a few decades ago, the number of schools, faculties, and departments of architecture with significant research activity was scarce and located primarily in North America, Western Europe and the British Isles, and Japan. But with the turn of the century, the commitment to research became more widespread and more fruitful. On the other hand, this flourishing of research activity also led to the emergence of a new generation of relevant topics which entered the scene to meet the traditional ones, gradually enough so as to be tackled by this growing community of academics and practitioners.

The consequences of the intense activity of the planet's growing population began to be unquestionably felt in the second half of the 20th century. Cultural landmarks such as the photograph "The Blue Marble" (fig. 1), taken on December 7, 1972, by the Apollo 17 crew on their way to the Moon when the spacecraft was 29,000 kilometers from Earth, constituted the foundations of the progressive collective awareness of the fragility of our planet. Public awareness in economically developed regions all over the world of the subsequent climate change would erupt in the late 1980s. However, the unprecedented increase of social concern on this matter turning it into apparently the most imperative priority would not arrive until the end of the 2010s. Society, led by the youth, began to take to the streets demanding a paradigm shift to avoid what was already considered a climate crisis or, at the very least, minimize its most serious consequences. And

this concern soon reached the institutions engaged in architectural research, which addressed it from multiple points of view, both analytical and proactive.



Figure 1. The Earth seen from Apollo 17 on December 7, 1972, also known as "The Blue Marble"

But on January 30, 2020, everything changed abruptly. The World Health Organization declared the coronavirus disease 2019 a public health emergency of international concern on January 30, 2020, and a pandemic just forty days later (fig. 2). During more than two years almost all the countries on the planet have devoted their efforts and most of its resources to control the malady and to overcome the frequent and meaningful consequences of the necessary isolation and even lockdowns on the economy. Architectural researchers have not been insensitive to this emergency and many have adapted their agenda in order to be helpful.



Figure 2. Tedros Adhanom Ghebreyesus, the World Health Organization's Director-General, declares the coronavirus disease 2019 a pandemic on March 11, 2020. (Source: New York Times)

By January 2022, the pandemic was in clear remission, its effects were increasingly under control, and daily life had returned to the previous normal in almost all countries of the world. There was nothing to suggest that the world was about to face another critical situation with global consequences. Unfortunately, the history of mankind has always had war conflicts going on. But the Russian invasion of Ukraine came as a real shock to world public opinion (fig. 3) because of the speed and forcefulness with which it unfolded at the beginning and because of the harshness of the images that television stations around the world broadcast. Concern about this conflict extends to all segments of society and that obviously includes those involved in research on architecture. A new script change in less than two years, a new priority to direct our attention to, because when the conflict is over there will be a whole country almost completely destroyed.

Has the world ever changed so rapidly? What is undeniable is that while still necessarily devoting our attention to those matters which became indispensable to us previous to these unexpected events such as poverty and migration, commonwealth and right to progress, feminism and inclusivity, interculturality and multiculturalism, childhood

and elderly, affordable housing and right to the city; and having rediscovered the need for combining these commendable ambitions with the rational use of raw materials and energy sources, and the adequate management of the built environment in order to make a feasible tomorrow for our planet; researchers on architecture have assumed our responsibility in assisting humanity to overcome the sanitary crisis and must be prompt to rebuild a whole country. While we were involved in participating in the universalization of the multiple derivatives that the right to happiness and to a dignified and satisfactory life entail, we are forced to dedicate a greater or lesser part of our efforts to making life itself possible.



Figure 3. Protest against the Russian invasion of Ukraine in Helsinki, Finland, on February 26, 2022

As a result, research on architecture must focus on a variety of topics whose priority has proved to be changeable depending on the geographical, economical, and temporary context. Indeed, current research on architecture seldom has a unique and linear approach to a single matter. On the contrary, multidisciplinary approaches for multipurpose goals are becoming more and more frequent. This trend is providing research on architecture with a noticeable resiliency and capability to adapt itself to changing scenarios and to develop aptitudes and proposals for immediately combating unexpected situations.

Paradoxically, all the skills we acquire to face the new situations of this time of change, will provide us with the best capabilities to face these changing priorities that force us to constantly rearrange our agendas.

The third edition of the Valencia International Biennial of Research in Architecture welcomed keynote speakers and papers on developing initiatives, ongoing activities and findings which made architecture and neighboring disciplines research adaptable, resilient, and essential for a variety of changing scenarios, especially for those matters with a current or imminent relevance. When the call for the conference was disseminated, the conflict in Eastern Europe had not begun yet. But it is undoubted that the capabilities of research in architecture for confronting a diversity of changing scenarios are the adequate ones for confronting this one as well. Hosted at the Higher Technical School of Architecture, the event took place from 9 to 11 November 2022 (fig. 4).



Figure 4. Corporate image of the 3rd Valencia International Biennial of Research in Architecture when the call for papers was formalized on February 22, 2022.

The organization committee agreed that in order to warrant a good present a better future for people around the planet and to safe the care of the Earth itself, research in architecture had to release all its potential. Therefore, the aims of the 3rd Valencia International Biennial of Research in Architecture were:

- To focus on the most relevant needs of humanity and the planet and what architectural research can do for solving them.
- To assess the evolution of architectural research in traditionally matters of interest and the current state of these popular and widespread topics.
- To deepen in the current state and findings of architectural research on subjects akin to post-capitalism and frequently related to equal opportunities and the universal right to personal development and happiness.
- To showcase all kinds of research related to the new and holistic concept of sustainability and to climate emergency.
- To place in the spotlight those ongoing works or available proposals developed by architectural researchers in order to combat the effects of the COVID-19 pandemic.
- To underline the capacity of architectural research to develop resiliency and abilities to adapt itself to changing priorities.
- To highlight architecture's multidisciplinary as a melting pot of multiple approaches, points of view and expertise.
- To open new perspectives for architectural research by promoting the development of multidisciplinary and inter-university networks and research groups.

For all that, the 3rd Valencia International Biennial of Research in Architecture was open not only to architects, but also for any academic, practitioner, professional or student with a determination to develop research in architecture or neighboring fields. The event encouraged the submission of papers concerning up to nine thematic

areas aiming to accommodate as many approaches as possible.

"Representation and quantifying" was the first thematic area or block. Graphic expression has proved itself as both a stimulating and fruitful field for architectural research and experimentation along with many other neighboring disciplines. Frequently used as a means for documenting and transferring information integrated in more complex processes, graphic words have occasionally become final results themselves and even cult objects. Quantifying and databases might play a similar role when it comes to portray situations and processes (fig. 5). In both cases, drawings and numbers are not just indispensable and inspiring tools, but also genuine reflections of our interests and occasionally, premonitory foresights of our aspirations. This thematic area welcomed papers from different fields of graphic expression and data gathering and processing which focused on the changeable priorities of architectural research nowadays.

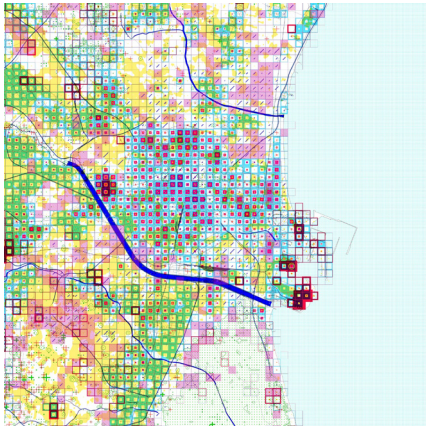


Figure 5. Urban expansion, population growth and forest gain for Valencia, Spain, during the last 45 years by 300.000 km/s Studio

The second thematic area or block was devoted to "City, territory and landscape". With their own internal and external dynamics and with their different scales, city, territory, and landscape constitute exciting scenarios to start work on from multidisciplinary and interdisciplinary points of view. Among these contexts, urban fabrics and public space constitute a base for research from morphological, functional, social, and environmental perspectives. This thematic area encompassed papers on the geographic field of the city, the territory, and the landscape. Among many others, topics addressed may included human scale, morphology and activity in the city, occupation, permanence, transformation, mobility, and obviously landscape as cultural heritage and daily life stage, through the point of view of the most relevant burning issues of the current context.

"Innovative practices and projects" was the name of the third block or thematic area. Design can be defined in many different manners, but one of the most popular options is the one describing it as an open answer to a complex question, which needs to be tested with more or less successful results when confronted with the different circumstances and boundary conditions of the particular case. The attitude of a designer when tackling a commission is decisive and a true announcement of the kind of outcome to be expected. Human life and the necessary habitat to conveniently develop it are nowadays more complex than ever and recently subjected to changing priorities and unexpected emergencies. This thematic area included papers on innovative practices and ways of doing when undertaking a commission in the architectural context, and papers on innovative projects capable of solving needs or offering options in unexpected and/or brand-new manners.

The fourth block or thematic area was booked for "Technology and materials". The ever more demanding social needs and

ambitions and comfort levels are mostly satisfied by innovative evolved materials and building technology. It is absolutely undeniable that the last century really passed the baton to the current one when it comes to go in innovating in products, building techniques, structural systems and conditioning. Accessing the right technology is frequently a determining factor when ambitioning to ensure the success of an urban or architectural project. This thematic area welcomed papers on, among many other topics, innovative materials for the building industry, building techniques for a better building and a better living, creative assessment or development of structural analysis and design, and improvement in conditioning techniques.

"Theory, criticism, narratives and ethics" was the fifth thematic area or block. The current architecture context demands a thorough reflection upon the role of theory and criticism in order to determine strong foundations for knowledge, judgement and design in architecture. On one side, reviewing the nowadays validity of contributions in theory and criticism on architecture and a variety of neighboring disciplines is a must. On the other side, it is always interesting to track links between theory and criticism with the current architectural practice and the ambitions, needs and priorities of contemporary society. Likewise, the lack of universalizable certainties and principles makes architectural narratives and ethics on architecture absolutely necessary. This thematic area encompassed papers of any kind related to theory, critical thinking, narrative and ethics in architecture and encourages all necessary debates, especially those introducing changing priorities as a decisive factor.

The sixth thematic area or block was devoted to "Heritage, restoration, conservation, and renovation". The interpretation of history has traditionally opened new ways to build the future. Geographical and timescales

frameworks are vast enough to cover stages which compromise from ancient cultures to contemporary times, being a transversal and multidisciplinary approach and an interesting endeavor. Likewise, the way that we relate to our heritage has meaningfully evolved during the last decades with innovative results which can be framed within the categories of restoration, conservation, and renovation (fig. 6). This thematic area encouraged papers on the critical reading of history of architecture, heritage, restoration, conservation, and renovation as a matter for any architectural research. These fields constitute an amazing window of opportunity in modern practices that has inducted the development of many fascinating research lines.



Figure 6. New access to the Camí d'Onda Air Raid Shelter in Borriana, Spain

"Participation, diversity and inclusiveness" provided the subject for the seventh block or thematic area. As previously mentioned, our society nowadays witnesses a process of reflection, reconsideration and even suppression of many traditional concepts and values such as hierarchical governance,

adequacy or even normality. People are increasingly claiming their rights to take command of whatever has a decisive influence on their lives and to be happy and accepted despite their features, preferences, and circumstances. Participation processes, diversity, inclusiveness and many other neighboring concepts have also arrived in daily architecture practice and are having an incipient bud deciding influence on how the discipline responds to the challenges of our needs and changing priorities. This thematic area welcomed papers dealing with new societal dynamics, their irruption in architecture professional practice and their influence on the architectural output. Examples of previous pioneering examples and study cases of any period will also be welcome.

The eight thematic area or block focused on "Sustainability and climate crisis". Initially related merely to energy and natural resources, the concept of sustainability has evolved and incorporated many other facets. Architectural production and building industry have a meaningful influence in several of these facets and convenient knowledge and practical implementation become a must for any practitioner in order to safe a logical present and a feasible tomorrow for the planet. Climate crisis is not a premonition anymore. Its effects and consequences can be assessed in too many aspects of our daily lives and in the environment. This thematic area welcomed papers on sustainability and/or climate crisis under the spotlight of research in architecture and neighboring disciplines, as one of the most relevant priorities of the current international context. Finally, the ninth thematic area meaning the last block was kept for "Health and pandemic". The irruption of the COVID-19 pandemic shocked the world, hit the economy and completely changed our lives three years ago. Home lockdown turned architecture into an indispensable prevention tool in order to keep under control the expansion of the disease and save our lives. This unexpected

and sudden home-isolation endowed us with a different perception of our places (fig. 7). Likewise the rediscovery of public buildings and outdoor spaces provided us with renewed expectations and a firm commitment of overcoming the sanitary crisis more resilient. But this has not been the first pandemic which has shaken humanity along history. Previous episodes caused by other maladies had a meaningful influence in how we designed and used architectural output. This thematic area welcomed papers on the influence of health issues and pandemics, with a special focus on the COVID-19 pandemic, on architecture and neighboring disciplines.

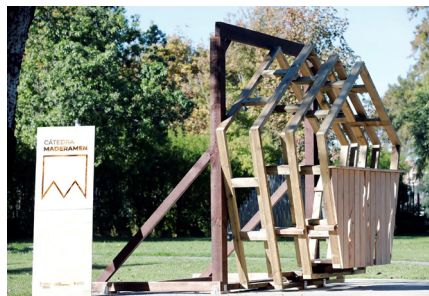


Figure 7. Prototype of an extendable wooden balcony developed by the Maderamen Chairship at the Polytechnic University of Valencia, Spain, in November 2021

Despite not evenly, all nine thematic areas were successful. Up to sixty papers made it through the Scientific Committee reviews and judgements. The conference proceedings compile all these works. Therefore, this book constitutes a privileged outlook of the research done by some of the best academics in architecture and neighboring fields in the world. It provides a valuable picture of nowadays state of the art, a fertile source supply for further research and an unbeatable testimony for the future.

1

REPRESENTATION AND QUANTIFYING

HOW DOES HOUSEHOLD INCOME AFFECT ACCESS TO HOUSING?

Begoña Serrano Lanzarote^a, Carmen Subiron Rodrigo^b

^aUniversitat Politècnica de València, Spain

^bValencian Building Institute, Valencia, Spain

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ABSTRACT

Accessing to housing, in addition to being a right, should be part of a market sufficiently accesible and diverse so as not to generate excessive expenses for households, which do not allow other necessities to be met or may jeopardise the quality of life.

This article considers the issue of access to housing by analysing the relationship between the average net income per household and the housing rental cost index, with the aim of quantifying the extent to which housing costs affect household income within the Comunitat Valenciana. It focuses especially on the rental system, regarded as the tenure regime prevailing for the most vulnerable households.

A compilation of the available data is undertaken, and with this information, the percentage of the average household income of families that must go to rent payment is calculated, and to what extent this economic effort is excessive. Different income brackets are established to analyse which sectors of the population have trouble accessing a home.

The results obtained suggest that a high percentage of households have to spend over 30% of income on paying rent, and it is in households with lower income in which this percentage soars, emphasising the situation of vulnerability.

Due to a lack of available data, it was not possible to geographically locate the areas with a *strained residential market*, defined by the

Draft Law on the Right to Housing, from which it can be deduced that adding data collection mechanisms to existing ones is necessary to achieve a detailed analysis, essential to implement more effective housing access policies in highly vulnerable areas.

KEYWORDS

Rental housing; rental charge; overstrain economic effort in households; strained residential market areas; rental household income.

1. INTRODUCTION

The European Parliament approved on January 21st, 2021 a resolution (European Parliament Resolution, 2021) calling on the Commission and the Member States to ensure that the right to adequate housing is recognised and enforceable, as a basic human right; to guarantee equal access for all to decent housing; and to include housing sector as a social service of general concern, and not just social housing.

Also, it points out that 25.1% of European tenants that pay market rent spend over 40% of their income on rent and, on average, rents are constantly increasing; therefore it calls on Member States and regional and local authorities to establish legislative provisions,

including clear rental regulations so as to protect the rights of tenants and owners.

Spain is one of the EU countries in which the largest percentage of the population lives in an owned home. It is for this reason that a large part of the economic efforts data obtained from public and private statistics has traditionally focused on learning about the purchase and sale market, at the expense of the rental market. Therefore, it is essential, to have data sources that enable rental housing market to be analysed, in order to set mechanisms that help guarantee access to housing (INE, 2022).

Various studies suggest that rental housing has worse economic conditions, and tenants make an overstrain economic effort to pay rent. Rental housing is a limited market in which owners can easily put pressure on prices and raise rents, thus creating what is called a *strained residential market area* that the *Draft Law on the Right to Housing* defines as the average burden of the mortgage cost or rent in the individual budget or in the family unit, plus basic expenses and supplies, exceeds 30% of average income of households, and also those areas in which the rent has risen 5% over the CPI in the last five years.

In order to set adequate policies that guarantee access to housing, it is necessary to know in depth and analyse the rental market, since it is the most affordable and effective way of access to housing for those sectors of population with very unfavorable economic conditions. For all these reasons, an effort must be made to ensure the availability of objective data in the housing rental market, which allow a valid analysis and diagnosis.

2. GOALS

The main goal of this study is to quantify the economic effort that families or cohabitation units must make to access a home, focusing the analysis on the rental system within the Comunitat Valenciana. Specifically, to quantify

the percentage of household income for rent payment of primary residence.

The first purpose is to collect available data on rental prices, as well as that available on net income of households in the Comunitat Valenciana. This way, it will be feasible to determine what type of analysis is currently possible, and what type of data should be collected in the future, in order to analyse the rental housing market effectively and objectively.

According to the available sources, the following goal is to examine the rental housing market to the extent that current data allows: type of tenure according to household income, extra economic effort that families must make according to income, size of the municipality, location and all those available variables that can be relevant.

3. RESULTS

3.1. Available data

Data sources on net household income in the Comunitat Valenciana:

- The National Statistics Institute (INE):
- Average net income per household by census sections, 2019.
- Living Conditions Survey (ECV).
Variable HY020: Total household available income (for rent) in the year prior to the survey, by Primary Sampling Unit (anonymised census section), by regions, 2019 and 2021.

Sources of data on housing rental prices in the Comunitat Valenciana:

- The National Statistics Institute (INE):
- Living Conditions Survey (ECV).
Variable HH060: Current rental price for occupied housing, by Primary Sampling Unit (anonymised census section), by regions, 2019 and 2021.
- The Ministry of Transport, Mobility and Urban Agenda:

- Housing rental index 2015-2020: result of the exploitation of tax sources within the framework of the development of the State system of reference for housing rental prices. Territorial-based data: census section, district, municipality, province and region.

OHsu Study on Housing Rental Prices in the Comunitat Valenciana 2020:

- Reference price: €/m² for studied areas smaller than the municipality, according to three sections of housing surface, and according to five construction periods.

Quarterly report on rental prices of the real estate agency Pisos.com, March 2021:

- Monthly rental price according to number of bedrooms (1, 2, 3, and 4), by province.

Some clarifications are included below in order to provide more information on the origin of the data and thus ease the understanding of the following analyses conducted.

Living Conditions Survey (ECV):

- The Living Conditions Survey (ECV), in English, European Statistics on Income and Living Conditions (EU-SILC) (Eurostat Statistical Office, 2022), belongs to the set of harmonised statistical operations for the EU countries.
- The key objective pursued with the ECV is to have a reference source on comparative statistics of the distribution of income and living conditions in Europe.
- In Spain, the survey has been conducted since 2004 on an annual basis, mainly through personal interviews with the population living in family homes. The data related to household income is based on a combination of the information provided by household respondents and administrative records.
- The sample size is around 13,000 households and 35,000 respondents.

Reference Index of Housing Rental Price:

- The second additional provision of the Royal Decree 7/2019, of March 1st, on urgent measures in the field of housing and rent, establishes the creation of the *State System of reference rates for housing rental prices*. In order to comply with this provision, a Technical Group was set up to develop the system, coordinated by the Ministry of Transport, Mobility and Urban Agenda.
- The development of the system responds to the lack of official statistics on prices, at the state level, as a reference for individuals and the different agents operating in this market.
- The scope is made up of the entire common fiscal territory, and the analysis of data is conducted in a disaggregated way at five administrative levels: census section, district, municipality, province and region.
- The information to be operated, originates from the IRPF model 100 of exercises corresponding to 2015, 2016, 2017, 2018, 2019 and 2020, and the information of the database of the General Directorate of Cadastre.

OHsu Study on Housing Rental Prices in the Comunitat Valenciana 2020:

- This study reflects the real cost of rent in the free market and is based on objective data from the rental finance register in the Comunitat Valenciana. It is built on real data forks of rental prices, grouped according to geographical areas, from which the evolution in the last three years is obtained.
- The monthly rental price in euros per square meter is calculated based on three variables that affect its amount: size of dwellings, construction period of buildings and location of dwellings. Likewise, the evolution of the rental price between 2016 and 2018 is calculated, and four evolution ranges are established: less than 10%, between 10% and 15%, between 15% and 20% and over 20%.

3.2. Rental price analysis

The different sources from official entities provide with similar data on the monthly rental price in the Comunitat Valenciana, in a range between 420 euros per month and 437 euros per month, although it must be considered that data sources are from different annuities.

On the other hand, the data from the real estate Internet portal Pisos.com is much higher, since it is not about final data of rental contracts but advertising data. So, this source is discarded because it does not adjust to the market reality.

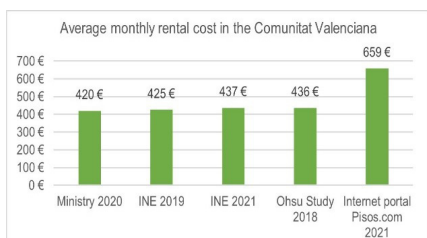


Figure 1. Average monthly rental price €/month in the Comunitat Valenciana, according to different sources

When analysing the data by provinces, only the data from the Ministry and those from the *Ohsu Study on Housing Rental Prices in the Comunitat Valenciana* can be compared. The INE data from the *Living Conditions Survey* (ECV) can only be extracted according to regions, since the primary sampling unit is the anonymous census section.

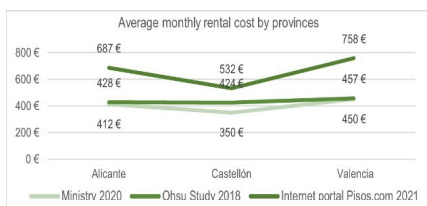


Figure 2. Average monthly rental cost €/month by provinces, according to different sources

3.3. Analysis feasibility of the available data

So as to analyse the extent to which income affects access to housing, and to quantify the overstrain economic effort that families must make to access it, focusing on the rental regime, the first obstacle spotted is the lack of data that allow to disaggregate the income of dwelling owners from those that rent dwellings.

The distribution of household income (ADRH) provided by the INE does not allow a breakdown of household income based on the housing tenure regime. Data is available at census section level, but counting on the result of all households.

If this household income (ADRH) is compared with the rental prices provided by the Ministry, the results are distorted, since the average household income includes the data of the highest incomes that generally own the home. In contrast, the lowest incomes, not being able to access the property, have rental housing.

The only source that enables to directly compare household income with tenancy regime, the rental price, etc., is the *Living Conditions Survey* (ECV) of the National Statistics Institute (INE). The issue lies in the fact that geographically, data can only be obtained at a regional level, since the primary sampling unit is anonymised.

For all these reasons, the analysis below is located in the geographical area of the Comunitat Valenciana, without being able to detail results by provinces or municipalities.

3.4. Analysis on type of housing tenure according to household income.

Based on the data from the ECV 2019 and 2021 within the Comunitat Valenciana, it is possible to analyse how household income affects the type of housing tenure: owned or rented.

Significantly, households with lower incomes are those with a higher percentage of rental system, whereas households with higher incomes tend to owned housing.

- Between 66-69% of rental housing in the Comunitat Valenciana have income \leq 25,000 euros per year.
- In households with incomes over 25,000 euros, the rental cost is between 34-35%, compared to 51-54% of owned housing.
- A rising trend in rent system is evident in the last two years, in households with lower income, whereas in those with higher income, the rising trend is in owned housing.

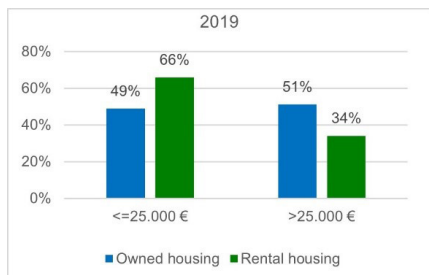


Figure 3. Type of home ownership according to average household income €/annual. 2019

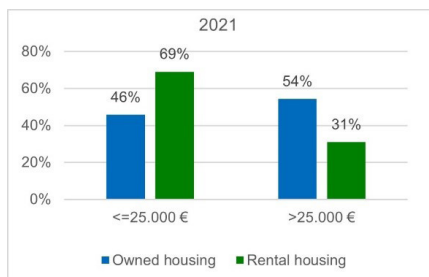


Figure 4. Type of home ownership according to average household income €/annual. 2021

If the data is analysed by narrower income brackets, interesting results can be obtained in the extreme brackets.

- Households with incomes \geq 40,000 euros represent only 7-8% of rental housing, and

the proportion between ownership and rental has remained stable in the period analysed.

- Households with incomes \leq 15,000 euros represent 32-40% of rental housing, and have significantly risen, whereas home ownership remains stable.

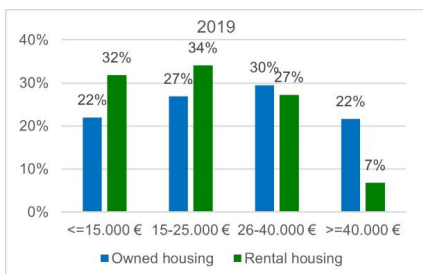


Figure 5. Type of home ownership according to average household income €/annual. 2019

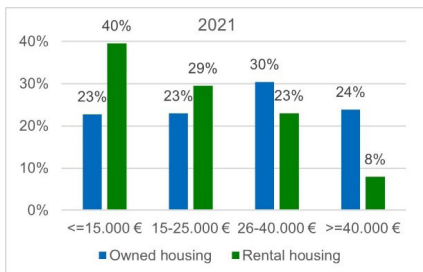


Figure 6. Type of home ownership according to average household income €/annual. 2021

If the average income per household in the Comunitat Valenciana is compared according to the housing tenure regime, a gap of 35-44% is obtained between the income of rental housing with respect to the income of owned housing. Noticeably, this gap has widened for the last two years.



Figure 7. Type of home ownership according to average household income €/annual. 2019 and 2021

If the analysis is focused on income in rental housing, which is the subject of this article, and five economic brackets are established, the following distribution is obtained:

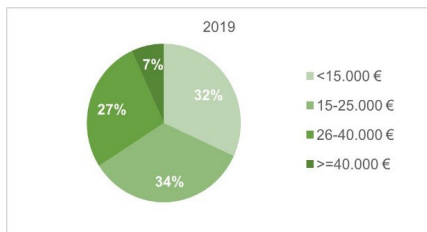


Figure 8. Percentage of rental housing according to average household income €/annual. 2019

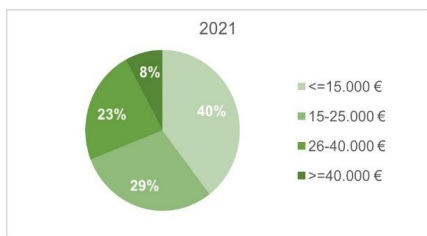


Figure 9. Percentage of rental housing according to average household income €/annual. 2021

3.5. Analysis of the relationship between income per household and rental cost

Based on the data from the ECV 2019 and 2021, the economic effort that households must make to pay the rent is analysed, that is, what percentage of the household income goes to rent payment of primary residence, within the total scope of the Comunitat Valenciana. As mentioned above, the data provided by the available sources does not allow to detail this analysis on a smaller scale, provincial- or municipal.

In addition, this analysis is detailed according to income brackets and other indicators that do appear in the survey, such as the size of municipality and the number of bedrooms in homes.

The *Draft Law on the Right to Housing* sets the *strained residential market areas* when the average burden of the mortgage cost or rent in the individual budget or in the cohabitation unit, plus basic expenses and supplies, exceeds 30 % of the average income in households, and also those areas in which the rent cost has risen by 5% over the CPI for the last five years.

Based on this *Draft Law*, in this study overstrain economic effort caused by rent payment is considered when the percentage of income required is $\geq 30\%$. Due to lack of data, basic expenses and supplies cannot be taken into account.

Economic effort in households to pay rent

Based on data from the ECV 2019 and 2021 in the Comunitat Valenciana, the percentage of household income for paying rent is analysed. In order to quantify this analysis, four groups concerning percentage of economic effort are established: those below 10%, between 10-20%, between 21-30%, and those $\geq 30\%$ of income.

In the following graphs it can be clearly seen that this huge economic effort affects approximately 40% of households, so it can

be concluded that rental costs are currently excessive for most families.

- Between 38-42% in rental households within the Comunitat Valenciana spends $\geq 30\%$ of their income on paying the rent of primary residence.
- In addition, there is a noticeable upward trend of overstrain economic effort, 5 percentage points, in the last two years.

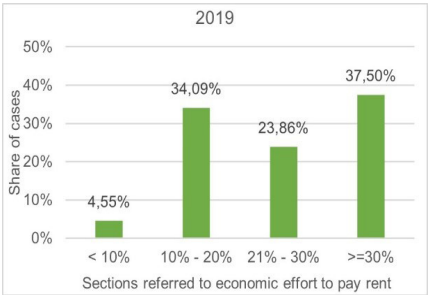


Figure 10. Percentage of households according to sections of overstrain economic effort to pay rent. 2019

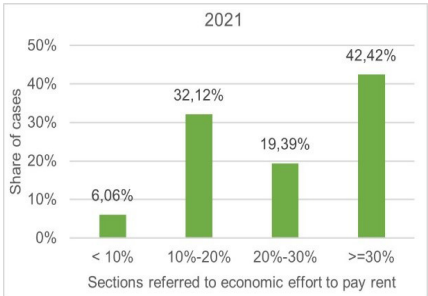


Figure 11. Percentage of households according to sections of overstrain economic effort to pay rent. 2021

Economic effort to pay rent according to household income

The previous section analyses the percentage of household income spent on paying rent cost, considering the overall income. This section aims to assess whether and to what extent this effort to pay the rent depends on household income.

In this section, those sections referred to economic effort are reduced to three: $\leq 20\%$, $20-30\%$, and $\geq 30\%$. For this, four income ranges per household are established: $\leq \text{€}15,000/\text{year}$; $\text{€}15,000-25,000/\text{year}$; $\text{€}25-40,000/\text{year}$; and $\geq \text{€}40,000/\text{year}$.

The results are quite significant, almost all households with lower income spend over 30% to pay the rent, whereas households with higher incomes never reach this percentage of economic effort.

When considering that the average net income per household within the Comunitat Valenciana is around $\text{€}25,000$ per year, it can be confirmed that households below that income are making an excessive economic effort to pay the rent, and those over that income have more reasonable percentage of economic effort.

Between 82-91% of rental households with income $\leq 15,000$ euros spend 30% or more on rent cost, which is an excessive economic effort. Furthermore, the scenario has worsened since 2019.

- Most households, 67-73%, with income over 40,000 euros, spend less than 20% on paying the rent. Likewise, most households, 79-75%, with income over 25,000 euros, spend less than 20% on paying the rent. In both cases, these figures have remained stable for the last two years.
- In the intermediate section $\text{€}15-25,000/\text{year}$, the distribution is more proportional, equaling in 2021 a third for each economic effort section.

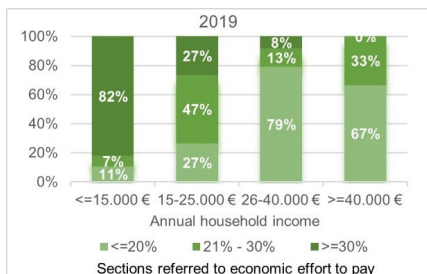


Figure 12. Percentage of households according to brackets of economic effort to pay rent, and according to brackets of household income. 2019

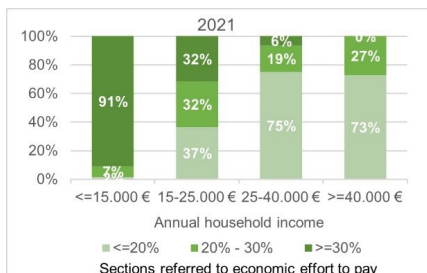


Figure 13. Percentage of households according to brackets of economic effort to pay rent, and according to brackets of household income. 2021

Economic effort to pay rent according to size of municipality

This section aims to analyse how the variable referring to the size of the municipality influences the economic effort in households to pay rent. In this case, only the data from the 2019 ECV can be studied, since in the following years this indicator was not considered in the survey.

The economic effort in paying the rent is greater in large municipalities over 100,000 inhabitants, since almost half of households spend over 30% of income. In municipalities with fewer than 10,000 inhabitants, more than

half of households spend less than 20% on paying rent.

- In municipalities over 100,000 inhabitants, 42% of households spend over 30%, and only 25% spend less than 20%.
- In municipalities with less than 10,000 inhabitants, 55% of households spend less than 20%.
- In municipalities with 10,000 to 100,000 inhabitants, the percentages are similar (32-36%) for the three sections referred to economic effort.

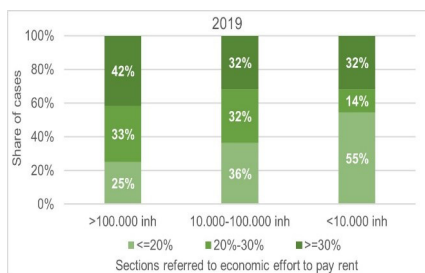


Figure 14. Percentage of households according to sections referred to economic effort to pay rent, by number of inhabitants of municipality. 2019

Economic effort to pay rent according to size of dwellings

This section aims to analyse how the variable referred to the size of dwellings influences the economic effort in households to pay rent. Based on the ECV data, a variable is established to indicate the number of bedrooms. Data from 1 or 2 bedrooms are neglected since the sample size was null or very small. Only the ECV 2019 is analysed.

The results do not show significant data, except for in rental dwellings with 5 or more bedrooms, the economic effort is less. This result may be associated with the fact that larger dwellings are rented by families with higher incomes.



Figure 15. Percentage of households according to sections referred to economic effort to pay rent, according to the number of bedrooms in the dwelling. 2019

3.6. Comparison at European and national level

Economic effort to pay rent according regions

In order to analyse the scenario in the Comunitat Valenciana within a national context, the data published by the *Report on Rental Housing in Spain*, by the Spanish Trade

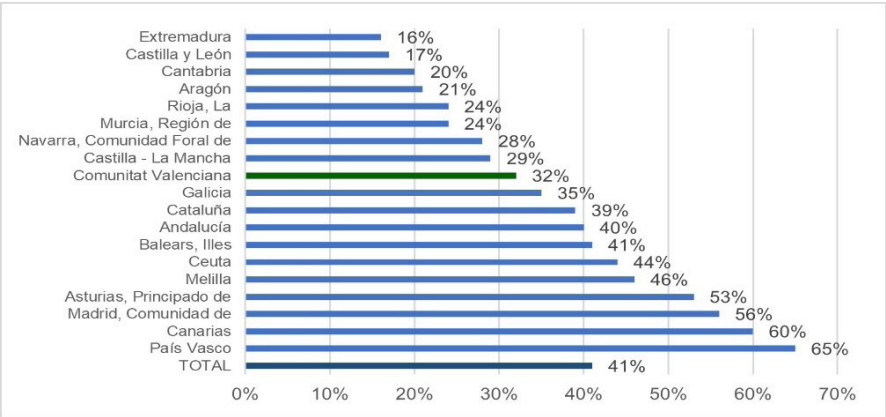
(Comisiones Obreras, 2021), including data from the 2019 ECV.

An analysis is made on the percentage of the population that spends over 30% of income on rent cost, according to regions. The variations with respect to the previously described data prepared by the authors are due to the fact that, in this case, percentages of population are used instead of number of households.

Economic effort to pay rent according to different European countries and tenure regime

The data analysed in this section comes from Eurostat (Eurostat, 2022) the EU Statistical Office. Eurostat is responsible for publishing high-quality statistics and indicators at European level, which enable comparisons to be made between countries and regions.

The *Income and Living Conditions* section covers four subjects: citizens at risk of poverty or social exclusion, income distribution and monetary poverty, living conditions and material deprivation, which are again structured into collections of



Union Comisiones Obreras, is considered indicators on specific matters.

Figure 16. Percentage of population with rental cost over 30% of income, according to regions, in 2019. Source: *Report on Rental Housing in Spain*, by the Spanish Trade Union Comisiones Obreras

The *Living Conditions* section contains indicators related to features and living conditions in households, particular characteristics of the population according to various breakdowns, health and labour conditions, housing conditions and indicators related to child care. In this section the data on housing to be analysed below is collected.

- According to an analysis of the evolution of the excessive overstrain rate in housing rent cost in Spain in the last four years, the result is as follows:

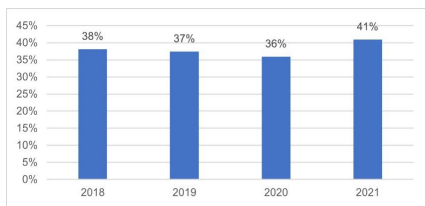


Figure 17. Evolution of overstrain rate in rental cost in Spain. Eurostat 2018-2021

- Distribution of the population, in percentage, according to housing tenure regime, whether owned or rented, in European countries. Spain is above average, with home ownership, 76%, compared to 24% for rent.
- The percentage of the population living in a household with an excess overstrain rate, that is, when total rental housing costs represent more than 40% of the household total disposable income. The cost of housing refers to the monthly rental costs, plus the costs of public utilities resulting from use of water, electricity, gas and heating. According to these figures, in Spain 37% of the population under rental status has an excessive overstrain rate, and it is over the European average.

4. CONCLUSIONS

The *Draft Law on the Right to Housing* determines the *strained residential market area* based on two variables, one in the event that the average economic effort on housing exceeds 30% of household income, and another that considers the evolution of the rental costs in the last five years.

- Currently, no data is available to analyse the economic effort in households to pay the rent in a localised way, census section or municipality, which was the subject of this research.
- As a consequence of not having this data, it is not possible to define the areas with a strained residential market based on household economic effort ($\geq 30\%$) within the Comunitat Valenciana.
- The alternative is to base it on the evolution of rental prices, as proposed in the *OHsu Study on Housing Rental Prices in the Comunitat Valenciana*.
- It is necessary to generate a source of data on the income in households for rent according to census section, comparable with the data currently provided by the *Ministry of Transport, Mobility and Urban Agenda* with the *Housing Rental Index* resulting from the exploitation of tax statistics and with data at the territorial level, census section, district, municipality, province and region.

Through the analysis conducted within the Comunitat Valenciana, the following conclusions can be drawn.

- Household income influences the housing tenure regime. If the stock of primary residence for rent is examined, almost half of it is occupied by households with income that does not exceed 15,000 euros per year, whereas households with incomes over 40,000 euros per year only represent 8% of this market. Furthermore, 66% of tenants live in households with income below 25,000 euros per year.

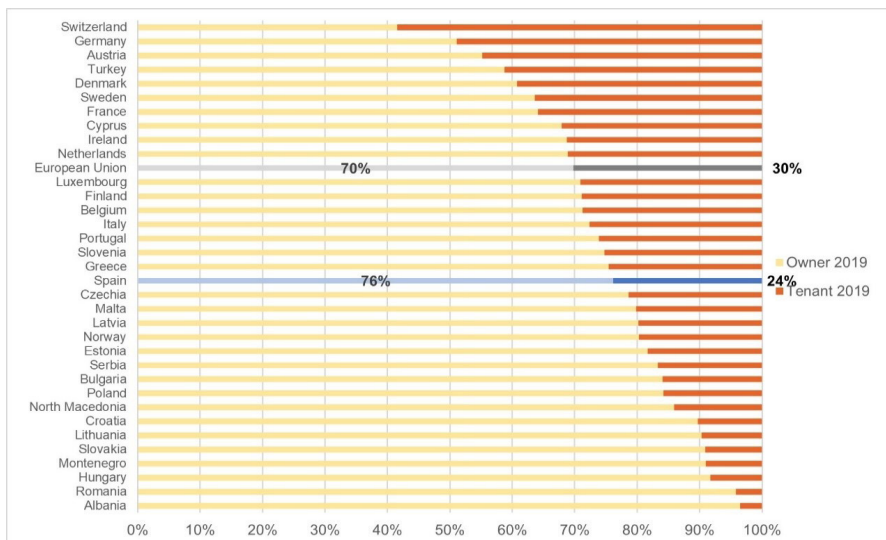


Figure 18. Distribution of the population according to tenure regime in Europe. EU-SILC Eurostat Survey 2019

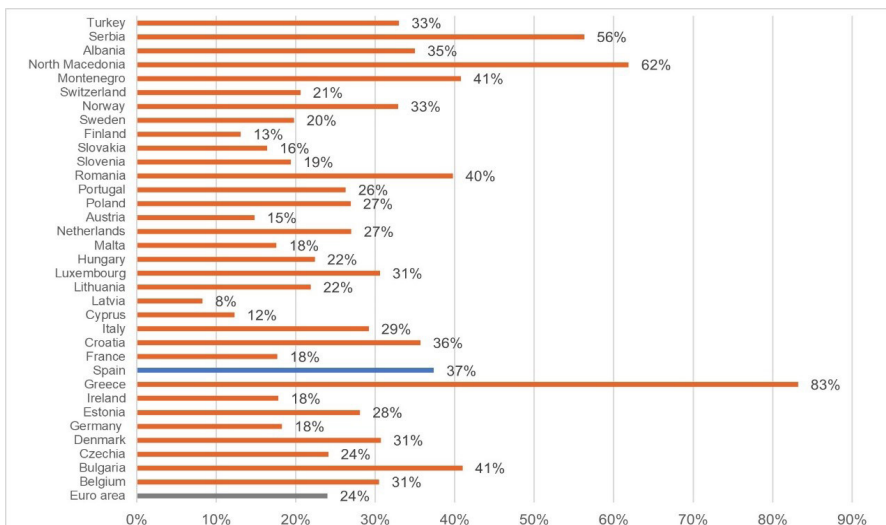


Figure 19. Percentage of the EU population with rental costing cost over 40% of income. EU-SILC Eurostat Survey 2019

- This data is confirmed in the event that the average income is compared according to tenure regime, which reflects a gap of 35-44% between income in rental households with respect to income in owned homes. In addition, this gap has increased in recent years.
- It is noted that a high percentage of households, around 40%, spend over 30% of income on paying rent, that is, they are located in *strained residential market areas*, although they cannot be localised geographically. This percentage has increased by 5 points in the last two years.
- In households with lower income, the economic effort to pay the rent soars, which sets them in a scenario of great vulnerability, since they must use most of their low income to pay rent. Between 80-90% of households with income below 15,000 euros per year spend over 30% on rental costs.
- Most of households with income over the average, 25,000 euros per year, spend less than 20% on rent cost, and only a percentage of 6-8% is regarded as overstrained.
- If the variable of the size of municipalities is considered, the economic efforts of families are greater in municipalities over 100,000 inhabitants. This information could not be cross checked with data from several annuities.

Compared to the rest of regions, the Comunitat Valenciana is slightly below the national average in terms of percentage of population spending over 30% of income on rent cost, 32% in the Comunitat Valenciana, compared to 41% in Spain.

If a parallel is drawn at a European level and the rate of overstrain economic effort is analysed, that is, when the total cost of rental housing is over 40% of the total disposable income in households, Spain is 12 points over the European average, 37%, that is to say, more than a third of the Spanish population living under rental status spends over 40% of income on housing costs.

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VISUALIZATION RESEARCH: SCOPING REVIEW ON DATA VISUALIZATION COURSES

Fabio Capra-Ribeiro^{a,b}

^aLouisiana State University, USA

^bUniversidad Internacional de Valencia, Spain

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ABSTRACT

Understanding data visualization as one of the foundational skills of the 21st century, this research aimed to define up-to-date guidelines to effectively teach data visualization courses and—from there—developed the first version of a new data visualization course. To do so, it faced the following questions: What is the current role of data visualization in higher education? What have been the main trends in data visualization courses in higher education? What methodologies have been used to teach data visualization courses? What difficulties have been identified in data visualization courses? What recommendations have been offered by previous professors that have taught this kind of courses? Considering this broad set of questions, the research was developed as a scoping review that served to collect hundreds of publications from where 22 peer-reviewed articles published between 2008 and 2021 were finally selected and analyzed. Among the most important results, the research found that data visualization interest in higher education has been growing exponentially and data visualization courses prioritize practical exercises over theoretical content. Some of the most common recommendations synthesized through the review suggested to select topics that the students should find interesting to promote their engagement. Also, several authors recommended to start the visualization process as soon as possible

and spend the least possible time on learning tools. Finally, the results of this review should be useful to support and promote new data visualization courses while they were already used to create the first iteration of a graduate and upper-level undergraduate professional elective course on data visualization under the title *Visualization Research*. The review and assessment of this course will be the next step of this research process.

KEYWORDS

Information representation; graphing; mapping; design studies; higher education.

1. INTRODUCTION

"We live in a data-saturated moment, in which [visualizations] distill complex realities into seemingly palpable truths" (Battista and Conte 2017, 147–48). This information representation process can improve people's lives by making it easier for them to access relevant information. But, unless it is communicated in a clear, engaging, and effective way, is very difficult for the message to reach the recipient. Furthermore, nowadays the amount of data and information grows exponentially, as well as the communication channels, which makes the whole process of representation and understanding more complicated. Even so,

images remain one of the clearest and most powerful means of communication, especially in a globalized world with different languages, disciplines, and perspectives in close contact.

"Generally, people, even without specific training, can still understand meanings graphs refer to. Considering the speed and efficiency, it is easier for people to memorize graphs than mass textual data. If a graph can exactly express the meaning, less explanation and shorter thinking process will be needed to understand. Compared with regionalism in language and character as well as obscurity in science and interdisciplinary knowledge, graphic symbols containing metaphor content can resolve the foothold of information in the communication of cross-cultural information (Yunqing, Linglin, and Yanzi 2016, 698)."

This almost universal condition is combined with the trust that society usually has on data, often understanding it as an irrevocable truth. The development of technology has made information visualization become involved in "every aspect of our life before we come to realize it" (Yunqing, Linglin, and Yanzi 2016, 696). Thus, there is a constant and growing demand for visualization design that must be addressed in higher education by training professionals with these skills. In this sense, it is important to study, develop and share experiences of visualization courses for "instructors to improve their teaching materials and help students achieve desired learning outcomes" (Lo, Ming, and Qu 2019, 11). So, understanding data visualization as one of the foundational skills of the 21st century, this research aims to define up-to-date guidelines to effectively teach data visualization courses. Complementary, the research expects to support the creation of the first version of a data visualization elective course to be implemented in the Louisiana State University School of Architecture. As this course will be available to undergraduate and graduate students in the College of Arts & Design, the research

focuses on data visualization for design related students. To achieve these objectives, the research seeks to understand what the current role of data visualization is in higher education? More specifically, what have been the main trends in data visualization courses in higher education? What methodologies have been used to teach data visualization courses? What difficulties have been identified in data visualization courses? What recommendations have been offered by previous professors that have taught this kind of courses?

2. METHODOLOGY

To address these questions, the research was based on a literature review focused on peer reviewed results of data visualization courses. Being this a topic-based search with several broad questions that could also include other reviews, it has been defined as a *scoping review*. The search centered on the term *data visualization*, being this a specific term that clearly identifies this area of knowledge. But the term *information representation* was also considered due to the well-known fact that it has been widely used to treat these topics. Thanks to the specificity of these terms, no more keywords were deemed necessary to define the topic. But the search also included the terms *learning* and *teaching* to focus on higher education. These two were favored over others such as *university*, *pedagogy*, and *course*, because they represented a simple solution that included any part of the educational process. It wasn't necessary to include any specific keywords about higher education because data visualization courses have mostly (if not only) been implemented in higher education scenarios. These keywords were organized in the following equation: TI/AB/KEY= ("data visualization" OR "information representation") AND TI/AB/KEY= ("learn*" OR "teach*"), which was adapted and implemented to three available databases: Web of Science, WorldCat, and Google Scholar. Combining the

results, 874 papers were initially collected, but after duplicates were removed, papers were screened by abstract and titles, and full text assessed for eligibility, the research

identified only 22 papers that focused on data visualization courses (Table 1). These documents were later analyzed in relation to the proposed research questions.

Title	Year	Authors
Innovative Pedagogy for Teaching and Learning Data Visualization	2021	Byrd, Vetria L.
Experience of Teaching Data Visualization using Project-based Learning	2021	Kammer, Dietrich; Stoll, Elena; Urban, Adam
Remote Instruction for Data Visualization Design—A Report from the Trenches	2021	Aerts, Jan; Peeters, Jannes; Bot, Jelmer; Kafetzaki, Danaï; Lamqaddam, Houda
What more than a hundred project groups reveal about teaching visualization	2020	Burch, Michael; Melby, Elisabeth
Information Visualization in the Educational Process: Current Trends	2020	Liu, Zhi-Jiang; Levina, Vera; Frolova, Yuliya
Introducing information visualization to design students	2020	Mauri, Michele
Teaching Data Visualization as a Skill	2019	Ryan, Lindy; Silver, Deborah; Laramée, Robert S.; Ebert, David
Learning Vis Tools: Teaching Data Visualization Tutorials	2019	Lo, Leo Yu-Ho; Ming, Yao; Qu, Huamin
Teaching Data Visualization in/nFirst-Year Courses	2019	Clement, Ryan
Teaching News Design and Data Visualization	2019	Britt, Rebecca Katherine
Creative Data Literacy: A Constructionist Approach to Teaching Information Visualization	2018	D'Ignazio, Catherine; Bhargava, Rahul
Teaching with data: Visualization and information as a critical process	2017	Battista, Andrew; Conte, Jill A
Teaching and Learning Data Visualization: Ideas and Assignments	2016	Nolan, Deborah; Perrett, Jamis
Teaching data visualization in evl's cyber-commons classroom	2016	Johnson, Andrew
Tool for teaching visualization techniques: Learning and homework assignments for multivariate data visualization	2016	von Landesberger, Tatiana; Brodtkorb, Felix; Schneider, Philipp; Ballweg, Kathrin
Using pedagogic design patterns for teaching and learning information visualization	2016	Craft, Brock; Emerson, R-m; Scott, Taylor Jackson
The Application of Information Visualization Design in Teaching Field	2016	Yunqing, Wan; Linglin, Tu; Yanzi, Liu
Teaching Students to Focus on the Data in Data Visualization	2015	Wolfe, Joanna
Teaching Information Visualization via Creative Design	2014	Spence, Bob
Aligning trends in mainstream media and data visualization with teaching practice	2012	Chong, Alan
Teaching Information Visualization	2008	Kerren, Andreas; Stasko, John T.; Dykes, Jason
What ordinary people need most from information visualization today	2008	Few, Stephen; Edge, Perceptual

Table 1. Documents selected for analysis.

3. RESULTS

The review served to identify several important issues such as the role of data visualization in higher education, teaching methodologies, and specific issues and recommendations. These results are organized below following the same order presented by the research questions.

3.1. The role of data visualization in higher education

The analyzed documents that mentioned the topic agreed that the importance of data visualization has been growing exponentially in all areas. "Data visualization has rapidly become a standard approach to interrogating and understanding the world" (D'Ignazio and Bhargava 2018). Its application has spread in research, business, journalism, etc., which is why "knowing how to collect, find, analyze, and communicate with data is of increasing importance in society" (D'Ignazio and Bhargava 2018). Recent research showed that in the US the demand for this skill grew 1500% in the last decade, from "1888 jobs in 2010 to 30327 jobs in 2018" (Ryan et al. 2019, 97).

Data scientists are increasingly valued in all kinds of industries to analyze exponentially growing information. But this is only part of the process. Today it is possible to observe governments, organizations, communities, that make decisions related to the way in which the information provided is presented. In other words, the good representation of information can increase the influence that it has on the audience (Yunqing, Linglin, and Yanzi 2016, 696), for better or worse.

Graphic representation allows to emphasize "statistical thinking over calculations" which, combined with the creation of beautiful and useful visualizations, "can be very rewarding for students" (Nolan and Perrett 2016, 15). It is important to prioritize teaching the thought process over the use of specific tools because

tools and trends change rapidly (Lo, Ming, and Qu 2019, 14). Likewise, data visualization is not a mechanical process in which certain numbers are expressed, it requires analyzing said data and understanding that its processing is not neutral, but rather requires taking decisions about the ideas that will be communicated (Wolfe 2015, 345–47).

Considering its recent expansion, the wide variety of industries and disciplines where it is applied, and its importance in research, data visualization have a great influence in today's world. The appropriate representation of information can solve many of the problems and opportunities that people face today, a representation that in turn becomes the tool to facilitate deeper thinking (Few and Edge 2008).

"Critically, the technical knowledge of how to work effectively with data is in the hands of a small class of specialists (D'Ignazio and Bhargava 2018)."

This is one of the reasons why it is necessary to train more people capable of appropriately representing information that can help others achieve their goals or understand concepts or ideas that could change their lives, or everyone's lives.

3.2. Two main trends in visualizations

Although some authors understand visualization as a "subfield of computer science" (Ryan et al. 2019, 95), it has been accelerating and diversifying thanks to multidisciplinary and technology. But many efforts around data visualization are still related with coding and using specific software to generate a spectrum of charts. This approach is leaving aside many other possibilities of analysis and representation. In this context, design—understood as the "the way in which something is planned and made" (Cambridge University Press n.d.)—has to play an important role.

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