New Housing Preferences in the COVID-19 Era: A Best-to-Worst Scaling Experiment

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Abstract. The COVID-19 pandemic in Italy, as in many countries around the world, has imposed rigid restrictions on outdoor activities, resulting in forced confinement. The new condition requires an analysis and a rethinking of the way of life and of the new pre- and post-pandemic needs related to the use of domestic spaces, necessary to work, study or carry out other daily activities.

Politecnico di Milano and Politecnico di Torino, with the collaboration of the institute of studies and research Scenari Immobiliari, have launched a survey for exploring the new needs and preferences of residents. These needs, which arose in conjunction with the pandemic, concern not only the desire to readapt their homes, but also to change them. In order to investigate these preferences, a questionnaire was developed using the Best to Worst Scaling (BWS).

The items consider both modifications of the internal distribution and interventions on the efficiency of domestic appliances and systems components. The study aims to highlight how the spread of the pandemic has changed housing needs and how physical space affects people's well-being.

Keywords: COVID-19 · Decision-making processes · Max Difference Analysis (MaxDiff) · Individual preferences · Living spaces · Analytical Best-Worst Score (ABW)

1 Introduction

In February 2020, the World Health Organization (WHO) officially announced the name of the new virus in SARS-COV-2 which causes the infection called COVID-19. In March of the same year, the disease has been recognized as an international public health emergency and as a pandemic [1]. Globally, to date, more than 135 million cases

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have been confirmed, almost 48 million are in Europe and around 3.7 million in Italy [2]. Countries and governments tried to react by applying place-based approaches to the different instances raised from the unexpected situation both on the health side, by adopting social distance measures, the lockdown and the use of masks, and on the socio-economic side, by providing fiscal support, announcing recovery funds and promoting tax breaks for specific energy efficiency interventions [3].

Rapidly people daily life changed, cities were locked down, schools, offices and all the non-essential professional activities were closed [4], to control the infection. Thus, social isolation and confinement have been adopted by most countries [5]. These restrictions, as widely discussed, have caused negative psychological effects as stress symptoms, anger, insomnia in the longer term [6, 7].

In Italy, the Decree of 9th March 2020[1] officially determined the lockdown for Italians. By focusing on the effects of the pandemic on the real estate market, before the COVID-19 [8], according to the report developed by the Real Estate Market Observatory (Osservatorio del Mercato Immobiliare, OMI), Italy experienced an uptick in sales between 2017 and 2018, and the most dynamic cities have been Milan (Lombardy Region) and Turin (Piedmont Region). Moreover, it emerged how half of Italians were not satisfied with their houses causing an increase of renovation works merely focused on the energetic efficiency and the adoption of sustainable solutions [9, 10].

The situation post-pandemic is still unpredictable, even if it is clear how new needs arose and the perception about the built environment changed [11]. By considering the opinion of urban planners and architects, it is urgent to think about the building density [12], to plan a city where the most important services can be accessed in 15 min (walking distance) [13], to probably modify the concept of offices, and to meet the instance of adaptability and resilience of houses [14].

Within this context, the purpose of the contribution is to understand how housing preferences changed in the inter and post COVID-19 era, with respect to new emerging needs, and in detail if Italians are more willing to readapt their current house or to move to another place. To answer these questions, Politecnico di Milano and Politecnico di Torino, with the collaboration of the institute of studies and research Scenari Immobiliari, have launched a survey specifically devoted to people who live in the metropolitan cities of Milan and Turin, by applying the Best-to-Worst Scaling (BWS) approach. These two areas are the ones most affected by the pandemic in Italy. Preferences of people living in urban areas have been collected since the people living in those contexts perceived strongly the lockdown restrictions and the population density shaped the incidence of COVID-19 cases [7, 15].

The paper is divided into six sections, after a general introduction, in the second part a literature review and a web search are proposed aimed at understanding how scholars and private as well as public institutions carried on analysis on this topic. In the third one, the methodology applied is explained and the questionnaire is further discussed in the fourth section. The preliminary results are then presented in the fifth, while the conclusions try to synthesize the main findings, limits and future perspective of the research.

[1] https://www.gazzettaufficiale.it/eli/gu/2020/03/09/62/sg/pdf.

2 The Effects of the Pandemic on the Housing Dimension

During and after the period of the lockdown, several surveys have been developed aimed at understanding how the pandemic affected our habits, our work, the perception of the built and of the natural environment, and more in general our lives. With the purpose of understanding how other studies on this topic have been structured, a literature review together with a web search have been carried. The Scopus database has been consulted and the search developed by using a set of keywords in order to narrow the analysis. Since the aim of this phase is to understand if and how other scholars have investigated the changes in housing preferences, the following keywords have been selected: "questionnaire" or "survey" and "COVID-19" and "housing". A total of 83 paper has been found and 8 have been analyzed in-depth after three phases of screening which contributes to understanding the coherence with the defined purpose. The first limitation was by title (41), the second by abstract (21) and the last one by reading the contribution. Most of the papers have been excluded since mostly related to psychological factors [16–18] and ethnic group disparities [19–21], while the remaining ones address the housing topic by considering different perspectives and identifying a set of questions and items important for the evaluation. The analysis has been developed by detecting the country where the survey has been administered, the aim of the study, the typology of survey structured, the methodology applied and software used for the elaboration of data and/or for its generation, the number of respondents and the main relevant items. Most of the studies (six out of eight) have been developed by European countries and the relation of the effects of the period of lockdown with health and mental health factors is very close. Focusing the attention on main findings related to the built environment, Amerio et al. [7] argued that inadequate indoor spaces with small dimensions, poor quality and without habitable balconies strongly affect the living conditions, since these characteristics influenced the adaptability of the houses to new needs arose during the pandemic [22]. Indeed, families which reported having a sufficient number of home environments are the ones with a shared or private open outdoor spaces, features that positively influenced also physical activity and contrasting sedentary behavior, especially of children [5, 23]. At the same time, teleworking has been influenced by the domestic spaces available and difficulties have been encountered such as the lack of suitable places, lack of support infrastructure and ergonomic conditions [24]. Among all the items detected, those which have been studied and considered important for the general well-being of people, forced to spend time and to work at home, concern the natural light system, the view, the natural ventilation, the acoustic insulation and also the presence of terraces, the number of bathrooms, etc. [25]. As it has been discussed by Marona and Tomal [26], it is not possible to judge if these needs are temporary or permanent and if they are going to affect the market demands and tenants preferences but also different private companies and public institutions working on the real estate sectors launched several surveys in order to understand it. The European Real Estate Society (ERES) administered a questionnaire conducted by the research team from the Manchester Urban Institute, at the University of Manchester, to analyze "Changing housing preferences and use of home due to the Covid-19 Pandemic"[2] and the elaboration of the results is still ongoing. The Global Real

[2] https://eres.org/index.php.

Estate Consultants Knight Frank[3] detected the opinion of 700 clients across 44 countries who are willing to change their homes in the next 12 months but in the same location. Furthermore, according to the ING survey[4], 45% of Europeans are thinking of moving home, while for what concerns Italians points of view, they prefer to move to small cities, better if located in rural context (57%) or peripheral areas given the possibility of the smart working (SWG survey[5] and Citrix Systems survey[6]). Given these premises, it is possible to underline how the lockdown changed the perception of the place where we live, both considering intrinsic characteristics as the internal layout, the furniture, the installations, the presence of balconies in addition to the extrinsic ones, as the location in urban, peri-urban context and the proximity to green areas. These results can affect the market demand and the orientation of the building sector and its prediction would be strategic in order to meet real needs.

3 Best Worst Scaling

BWS is supported by the random utility theory (RUT) and was proposed by Finn & Louviere [27]. BWS takes advantage of the fact that collecting "worst" information, similar to "best" information, provides more information than the discrete choice models used in market research. BWS starts from the idea that individuals evaluating a set of three or more objects or elements on a subjective scale, the choice of the upper and lower object should be more reliable than the ranking of the objects, as required, for example, by the ranking method of conjoint analysis which asks you to sort the alternatives by preference. This method has the advantage of requiring less effort and time to identify the best and worst alternative without having to classify those in the middle. The disadvantage, however, is that the information detected is rather limited: in fact, the order of preference between the unselected alternatives and the distance between them are not known.

Among the simple methods for calculating MaxDiff scores, Analytical Best-Worst Score (ABW) proposed by Lipovetsky & Conklin [28] was chosen. ABW is calculated as following Eq. (1):

$$ABW = ln\left(\frac{1 + NBW}{1 - NBW}\right) \tag{1}$$

where NBW is the best-worst score normalized by the unit calculated according to Eq. (2):

$$NBW = \frac{\#Bests - \#Worsts}{Total\ times\ shown} \tag{2}$$

where the difference between *#Bests* and *#Worsts* (the number of times an item is selected as best and worst respectively) is divided by the number of times the item is

[3] https://www.knightfrank.com/research/article/2020-08-05-global-buyer-survey-2020-normal-20.

[4] https://think.ing.com/articles/ing-survey-pandemic-or-not-europeans-want-to-move-home.

[5] https://www.swg.it/osservatorio.

[6] https://www.citrix.com/it-it/news/announcements/jan-2021/citrix-and-onepoll-reserch-about-remote-work-it.html.

shown. ABW has a lower error than the Best Minus Worst Scoring for the estimation of latent values of elements proposed by Finn and Louviere [27], and can compare to multinomial logit models while being more computationally efficient [29].

4 Methodological Approach

The Metropolitan cities of Milan and Turin (North-Western Italy) represent the testbed area (Fig. 1) where the new needs and preferences of the citizens are explored. The choice of these two areas is, firstly, related to the higher spreading of COVID-19 compared to other regions in Italy since the beginning of the pandemic and, secondly, the collaboration among Politecnico di Milano, Politecnico di Torino and the Institute of Scenari Immobiliari[7]. In order to investigate these changing preferences, a questionnaire was developed using the Best to Worst Scaling (BWS). The research aims at ordering various attributes, asking the interviewee to select the best and worst options (attributes) within different choice sets built through an orthogonal design.

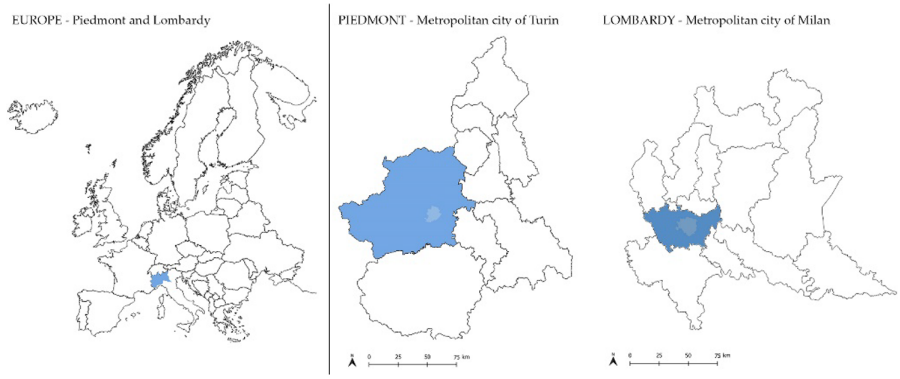

Fig. 1. Localization of the metropolitan cities of Milan and Turin (North-Western Italy) in Europe

Due to the pandemic situation and to collect a great number of answers in a short time, the questionnaire was built in an online format. For the validation and verification of the questionnaire, a first version has been sent to a group of experts and the institute of Scenari Immobiliari. Once obtained their answers, the final version of the questionnaire has been distributed through different social platforms and proper channels of communication (e.g. Facebook, LinkedIn, etc.) to obtain a representative sample of the different socio-demographic profiles. The data collection, for the preliminary analysis, has been undertaken between August and October 2020.

The final version of the questionnaire consists of three sections and an introductory part, called Sect. 0, which contains the motivations and aim of the analysis with a brief description of the broader context of the study. In this section, the sample is also limited to citizens with legal age ($\geq$18 years old) and who reside stably in one of the municipalities within the metropolitan cities of Milan or Turin.

[7] https://www.scenari-immobiliari.it/

Section 1 investigates the habits of respondents during the lockdown. With lockdown, we refer to the period between March 9 and May 3 2020, when the Ministerial Decree announced the closure of all activities throughout Italy, except the basic services, and the restriction measures that require staying at home for almost 24 h a day, with the only exceptions related to serious work or health reasons. The interviewee is also asked to describe the characteristics of his/her property and how preferences have changed during the pandemic.

Section 2 contains the experimental part. Using BWS, we ask the interviewee to choose the most relevant action for improving and adapting his/her house/apartment, as well as the least important one, within different choice sets.

Finally, Sect. 3 collects the main socio-economic characteristics of the interviewee, such as age, family members, employment, level of education, income.

The different choice sets (210 in total) contained in Sect. 2 were generated through an experimental design, performed in the SPSS software and characterized by 30 items. The items consider both changes in the internal distribution (i.e. construction of mezzanines, a different internal organization of the spaces), and interventions on the efficiency of domestic appliances and components (i.e. substitution of old windows, wiring, replacement of appliances). These 30 items have been identified after the consultation of various sources, both scientific and grey literature (see Sect. 2).

The survey was built using the Sawtooth – MaxDiff (Maximum Difference Scaling) software and proposes eight combinations of actions/items for each respondent. Each combination contains five actions/items, and, among the five, the respondent selects the most and the least important ones related to the improvement and adaptation of his/her property. Table 1 shows an exemplary combination of choice sets as similar as represented to the respondent.

The respondent chooses the 'most important' and 'least important' item to improve/adapt his/her property in each of the eight sets.

Table 1. Examples of choice sets used in the BTW survey

Most important item	Choice set 1	Least important item
○	30. Purchase of new furniture suitable for the new needs	○
○	25. Purchase of air purification equipment	○
○	23. Replacing the boiler	○
○	22. Installation of a solar-thermal system to produce hot water	○
○	11. Installation of an air conditioning system	○
Most important item	Choice set 2	Least important item
○	21. Installation of a photovoltaic system to produce electricity	○
○	10. Upgrading of the existing Internet connection	○

(*continued*)

Table 1. (*continued*)

Most important item	Choice set 2	Least important item
○	13. Installation of additional electrical outlets	○
○	12. Refurbishment of the electrical system	○
○	5. Differently organization of spaces for dining	○
Most important item	Choice set 8	Least important item
○	29. Replacement of interior doors	○
○	18. Replacing the old dishwasher with a low-energy one	○
○	2. Acquisition of additional spaces (construction of new spaces, where possible, such as the creation of mezzanines, the recovery of attics, closets, etc.) staying in the same house	○
○	4. Different organization of internal spaces to be used for studying/working	○
○	12. Refurbishment of the electrical system	○

5 Preliminary Results

The ongoing research has allowed to collect and analyze about 450 questionnaires. The sample is balanced between the two metropolitan cities: 52% lives in the metropolitan city of Turin, while 48% in the metropolitan city of Milan. The average age of the sample is 41 years old and 86% of respondents have more than 30 years old. The sample is perfectly in line with the aim to investigate the impacts of the COVID-19 restrictions on the needs related to work-at-home activities. Of the entire sample, 65% of respondents highlight how the lockdown period has affected the use of residential spaces, justifying the idea at the basis of this research. About the properties, 74% of them are apartments and the majority (60%) are located in the two main cities (Milan and Turin). However, despite the difficulties reported, most of the respondents would not change their actual place of residence (i.e. from a city to a town or a village and vice versa), as well as the type of property (92% buying vs. 8% renting). Alternatively, they would be more inclined to change the type of property, in particular to single-family houses. This can be explained by the many hours per day spent within indoor spaces, thus the presence of a private garden or an outdoor space has become increasingly important in the new habits and needs of people.

In the BWS task (second part of the questionnaire), the respondents have to choose the best and worst options in each comparison set. The results shows that the respondents consider as the most urgent the creation of suitable spaces to be used for work (1.05 in the BWS scores) and study (0.89), as well as the presence of an efficient WI-FI connection (1.00). Moreover, the respondents also give importance to the acquisition, where possible, of additional spaces in order to remain in the same property (0.77)

or the installation of an air conditioning system (0.77). Conversely, the least urgent actions highlighted by the respondents regard the replacement of interior doors (−1.36) and the installation of a surveillance system (−1.18), even if those aspects are not associated with intense or costly requalification measures. Moreover, the answers have shown low interest in the substitution of existing domestic appliances, such as the oven (−0.80) and dishwasher (−0.98), or extra new electrical outlets (−0.83). This behavior can be interpreted in different ways. Firstly, it could highlight the current presence of high performing appliances in properties. Secondly, it could be associated with a small variation in the electricity costs incurred before and during the pandemic. Thirdly, it can be related to low interest in the negative effects on the environment caused by energy consumptions. The latter is still less likely since many respondents consider as quite important the installation of a photovoltaic system to produce electricity (0.50) or a solar-thermal system to produce hot water (0.47).

6 Conclusions

The unpredictable situation, that we still experience regarding the spread of the COVID-19, requires to examine in-depth and to rethink our way of life. In this context, it is fundamental to analyze the new pre, inter and post-pandemic needs relating to the use of our domestic spaces, that have become, at the same time, the place of working, studying and carrying out all the other daily activities. The study aims to highlight how the spread of the pandemic has changed housing needs and how physical space has influenced people's well-being, despite the digital revolution aiming to completely remove physical barriers and promote efficient interaction.

Considering the metropolitan areas of the cities of Turin and Milan (Northern Italy), the methodological approach proposed in this paper uses the BWS method in order to understand the residents' new habits and preferences and highlight the needs that have emerged during the lockdown period. These new needs could lead people to make different changes in their property, or even to change the type of property or the actual municipality/city of residence. Thus, the further results will provide an overview of the adaptability of the actual living spaces through their modification or, conversely, the need to purchase a new property and/or change the place of living.

Through the preliminary analysis conducted, the results clearly show that the lockdown period had a strong impact on the use of residential spaces for more than half of the population, and many of them have expressed a need for outdoor spaces where to have fun. The most urgent upgrading on the properties, highlighted by the respondents, concerns the re-organization of space for studying or working and a high-efficiency internet connection. Conversely, the least important items regard aesthetic improvements or the installation of a security system, as well as buying more efficient domestic appliances or improving the electrical system.

Future perspectives of this work will provide a greater number of responses to the questionnaire in order to obtain a larger sample. In particular, the data collected will be further analyzed with multinomial statistical methods by even more segmenting the sample. A segmented analysis could investigate the different scores in the items between the two Metropolitan cities; moreover, the sample could be segmented for types of

properties (if a single-family house, detached or apartment), place of residence (village, small town or a big city) or it could be possible to show if preferences in the items changing with age, education or income. It would be also of scientific interest to consider the BTW scores for selecting a smaller set of items that could be further explored by means of BTW multicriteria decision-making method [28].

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