

B4F - *Balcony for the future*. An architectural assessment of home balconies for the “new” post-pandemic era in Lisbon and Warsaw

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Expected Future Partner Institutions

Politecnico di Milano (PM), Milan, Italy; Faculty of Architecture and the Built Environment at Delft University of Technology (TU Delft), Delft, Netherlands; Hong Kong Chemical, Biological & Environmental Engineering Society (HKCBES), Hong Kong, China

OBJECTIVES

Recently, the world population experienced major lockdowns due to the COVID-19 pandemic. The stay-at-home orders impacted people's interpersonal relationships and their perception of home and surroundings quality. Therefore, the proposed study aims to develop the following objectives:

1. Phase 1 - B4F Survey - Assess the importance and fundamental design features/activities that a balcony should present in the future by grouping them into key parameters through a survey to run over selected key informants in Lisbon, Portugal, and Warsaw, Poland;
2. Phase 2 - B4F Tool - The phase 1 outcomes enable the tool development that aims to rate the balcony's overall quality features in both cities, and;
3. Rethink the features of Balconies in future designs and pave the road to new research paths towards unveiling crossing potentialities with Renewable Energy Sources, forced ventilation, and structural design assessment to help the EU 2030 goals of turning buildings into energy positive (PEB).

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ABSTRACT + IMAGES

Balconies represent a semi-private/open area where the private life of inhabitants might take place, which importance rose during the COVID-19 pandemic under outdoor space restrictions to ensure social distance, isolation, and health safety. As a result, the use of home balconies increased, taking advantage of their qualities as non-specified programmed areas suitable to accommodate a wide range of activities. Balconies were especially useful in warm Mediterranean climates, where public areas gather the main social interactions, such as squares, avenues/streets, gardens, and terraces/rooftops up to sunset time or even further during the warm seasons. In 2020, researchers presented the term “urban balconies.” A concept related to the transference of the primary outdoor activities elevated from the streets sidewalks to “safer” balcony areas, resulting in the “rediscovery” of these semi-private outdoor spaces. In high urbanized dwelling areas, the home balcony rapidly become the only possible space for the entire family, increasing the need to rearrange spaces to cope with online work, learning, and relaxing.

Not all European citizens enjoyed the pandemic's limitations and lockdown periods in the same way. The families living in single houses had the possibility to access outdoor private areas, such as gardens, terraces, or pools. In contrast, the ones living in apartments were confined to a balcony, or none, in the worst-case scenario. Therefore, home balconies become a convenient and valuable space to respond to the imposed limitations, favoring their non-attributed functions. Additionally, they also represent, in the knowledge of the health medical community, an important tool to prevent physical and mental illness by enabling contact with the outside world. This phenomenon pushes for rethinking the methods of designing new and existing balconies.

In this way, the research proposal aims to design a tool to measure the architectural quality of a home balcony addressing the good design by assessing different features, from size and shape, aesthetics, activities, and functions to thermal and energy performance.

The study proposes three research phases: the phase 1 B4F Survey, to assess the fundamental design features to establish key performance indicators (KPI) on the post-pandemic balcony use; and the phase 2 B4F Tool for balconies rating, upon the survey KPI, serves to rate the quality of a new or existing home balcony in the incoming prosed design to enable the foreseen opportunities for improved future use (2023/2024 FCT call for IC&DT). Phase 2 pave the road for a phase 3 B4F Architecture Plug-in model based on previous knowledge and oriented towards EU 2030 goals on turning the existing building

into Positive Energy Buildings, empowering the balconies features for broader use (similar to pandemic-ready) and as an answer to rise efficiency and comfort in existing dwellings.

The B4F Survey analyses two different European climate contexts: the temperate, dry summer, hot summer (Csa), represented by Lisbon, Portugal; and the cold, no dry season, warm summer (Dfb), of Warsaw, Poland (Köppen-Geiger classification). The survey aims to collect data from framing the future use of balconies by inquiring Architecture master students from Faculdade de Arquitetura - Universidade de Lisboa and Faculty of Architecture - Warsaw University of Technology, which hypothetically gather two qualities as future homeowners and the incoming balcony designers.

The B4F Tool will be available under a webpage on both faculties' servers, reflecting the survey answers. The team intends to re-access with masters' students from the next academic to increase the data reliability and measure opinion deviation. The webpage will provide helpful information for architects, urban developers, and property markets crossing the rate with the energy capacity, thermal efficiency, ventilation ability, and economic value.

The path for the B4F Architecture Plug-in proposal will incorporate passive and active design strategies, such as Solar Renewable Energy Sources (RES) gathering, wind deflection, and shadowing optimized upon a generative tool to provide design adjustment to several archetypes. The methodology considers Lisbon and Warsaw climate particularities and will resorts to generative tools to create a modular constructive element aligned with EU 2030 goals by empowering the Positive Energy Buildings goal under cost-optimizing strategies considering structures, architecture features, its construction/assembly, and maintenance.

The research team consists of architects-specialists in building energy performance, tridimensional architectural surveys, and structural and material optimization. The involved interdisciplinarity raises the opportunity to grow their awareness, not only to related branches of sciences but also will probably enable new branches to develop and ensure the wellbeing of our and others' communities.

Please rank the following options according to your preferences. Where the one in the top is the “most relevant”.

Options	Importance
1. Comfort	
<i>The Balcony...</i>	
a. gets direct sun and light	<input type="checkbox"/>
b. gets enough natural shading	<input type="checkbox"/>
c. gives you a warm sensation	<input type="checkbox"/>
d. gives you a cooling sensation	<input type="checkbox"/>
e. is in a quiet place	<input type="checkbox"/>
2. View engagement	
<i>The Balcony is facing a view of the...</i>	
a. street	<input type="checkbox"/>
b. square	<input type="checkbox"/>
c. garden	<input type="checkbox"/>
d. city skyline	<input type="checkbox"/>
e. sea/river	<input type="checkbox"/>
f. rural landscape	<input type="checkbox"/>
3. Orientation	
<i>The Balcony is oriented towards the...</i>	
a. south quadrant	<input type="checkbox"/>
b. east quadrant	<input type="checkbox"/>
c. west quadrant	<input type="checkbox"/>
d. north quadrant	<input type="checkbox"/>
4. Aesthetics	
<i>The most important feature in a balcony is...</i>	
a. size	<input type="checkbox"/>
b. surface colors	<input type="checkbox"/>
c. shape	<input type="checkbox"/>
f. finishing materials	<input type="checkbox"/>
e. height	<input type="checkbox"/>
f. Greenery	<input type="checkbox"/>
Continues...	

Table 1 - B4F survey initial draft based on a ranking system. Designed by the authors.

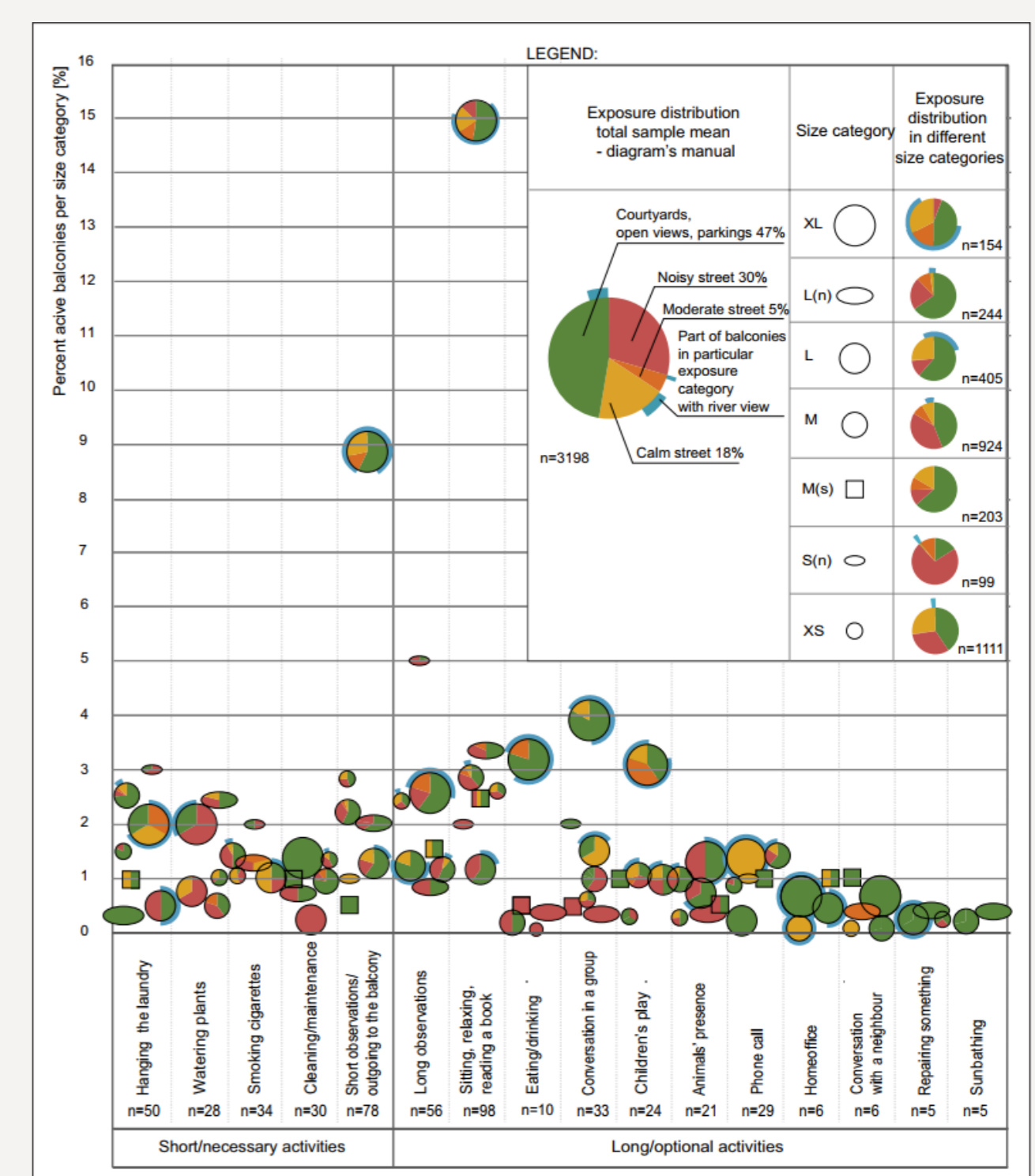


Fig. 1 - An example of balcony activity assessment based on survey. Adapted by the authors from Smektala and Baborska-Narożny (2022, p. 142).



Fig. 2 - Research proposal inspirational idea for phase 3 based on Lacaton&Vassal, Druot and Hutin architects work in existing building transformations. 530 units in Blocks G, H, I, Grand Parc neighborhood, Bordeaux. Photography by Philippe Ruault. Adapted by the authors from Lacaton&Vassal.com

SCIENTIFIC RELEVANCE FOR THE DISCIPLINE

The study aims to establish the metrics of balconies relevance to users, redefining its architecture design and future exploitation on EU 2030 goals, Positive Energy Buildings, through:

- The design of touch-screens surveys to gather architectural users' data;
- The identification balcony main architectural features, namely its possible shape, dimensions, and construction materials, essential to keep high levels of architectural and urban quality;
- The definition of balconies' KPI to rate its performance in new and updated building, and;
- The establishment of a webpage platform to guide architectural design towards a balcony aligned with today's user.

EXPECTED ECONOMIC AND SOCIAL IMPACT

Lisbon and Warsaw represent two distant European territories that recently gathered unique experiences under the COVID-19 lockdowns. For many people during these uncertain and challenging times, the balcony was the only space available to participate in urban life. Portugal and Poland's populations played a different part in this event, considering their geographic location, cultural backgrounds, climate and economic conditions, and individual expression particularities.

The present research expects not only to assess and compare both countries' perspectives on this issue but also to conceive a tool that paves the way for the *Balcony for the Future* design. The team envisions home balconies displaying a set of features that allow the extension of home borders, benefit people's physical and mental health, improve energy-related building performance at controlled costs, and is ready to deal with future pandemics providing a unique space/experience to the aging European population.

RESEARCH PLAN AND TASKS

COVID-19 pandemic, under the high contagion phase, disrupted the daily life of the European citizens, mainly during the compulsory home confinements imposed by national health authorities, aiming to slow the virus's spread among the community (Millán-Jiménez et al., 2021). The measures started with social distancing announcements and rapidly became stay-at-home orders depriving most populated urban areas of outdoor recreational activities, being restricted to the borders of their home 24/7 for weeks (Millán-Jiménez et al., 2021; Wilder-Smith & Freedman, 2020).

The amount of time spent at home increased the importance of having a safe, private outdoor space (e.g., balcony, terrace, or garden) whose features enable physical and mental escape, outdoor leisure time, and contact with the external surroundings (Aydin & Sayar, 2020; Molaei et al., 2021). In this context, the balcony as a semi-open area plays a key role in the inhabitant's outdoor access and is a challenge for architects and urban developers in charge of new and updated building design (Aydin & Sayar, 2020).

The proposal is grounded on Gropius's idea (1956) that architecture tends to mirror the society of each historical period. The changes induced by the COVID-19 pandemic shattered the existing paradigm of how indoor and outdoor living spaces are perceived (de Rosa & Mannarini, 2021), forcing the home balcony into new levels of ambiguity. Its basic features, boundaries, activities, and users' interactions, together with bioclimatic-related advantages, are now in a grey area pushing for new developments. Therefore, the study proposes to rethink the balcony for the future, having presented the pandemic lessons towards a tailored-fit design and configuration in the European context, opening the discussion among the scientific community, students, and related professionals.

To address the described, the team presents the following goals concerning the home balcony concept from a user's perspective:

1. Measure the importance between the pre- and post-pandemic periods;
2. Quantify the tendential develop activities;
3. Compare design key features;
4. Analyze the potential models to restore the urban/architectural homogeneity, and;
5. Propose models to address the EU 2030 goals for new and upgraded buildings.

The proposed research is structured in two phases: phase 1 – B4F Survey; and phase 2 – B4F Tool.

In phase 1 - B4F Survey, the team will resort to a post-occupancy evaluation through an online survey of key respondents in Lisbon and Warsaw (Architecture master students). The survey aims to generate data concerning the balcony's key performance indicators (KPI), e.g., comfort, view engagement, orientation, aesthetics, connection/organization, air quality, activity, and interaction potential. The outcomes will design patterns rated by categories/themes to be further analyzed, measured, and discussed.

The team's main activities involve engaging in conversations with the Faculdade de Arquitetura – Universidade de Lisboa (FA-UL) and Faculty of Architecture - Warsaw University of Technology (FA-WUT) governing bodies to run the B4F Survey, collect and process data, plus the KPI's metrics. The team also intends to run a second survey, after a year from the first, on identified group, but with different respondents, using the same methods to measure opinion deviation.

In phase 2, B4F Tool resorts to developing a mathematical rating tool of balconies users' interest supported by phase 1 KPI. The outcomes aim to rate the architectural quality of any existing and influence the incoming designs of multi-home balconies in Lisbon and Warsaw. The team expects to develop an interactive interface for Android and IOS terminal to engage a wider number of informants, increasing the KPI accuracy and reliability. The tool validation and benchmark will resort to reverse assessment when selecting building typologies in Lisbon and Warsaw. Preferably, the team will seek to address the most prominent residential building typologies of the XX and XXI centuries. Nonetheless, it also intends to cover the ratings of new buildings' balconies. The Portuguese and Polish teams have privileged access to Architecture master students of FA-UL and FA-WUT, which strengthen the study and its development, outcomes, and conclusions and deepen the collaboration between institutions.

The proposal presents the following tasks:

Phase 1: B4F Survey (estimated duration of 6 to 8 months):

- Phase planning;
- Survey design and methodological approach;
- Official survey approval by FA-UL, Portugal and FA-WUT, Poland;
- Implementation/run in FA-UL, Portugal and FA-WUT, Poland;
- Data processing, analyses, and results, and;
- Outcomes discussion.

Phase 2: B4F Tool (estimated duration of 6 to 8 months):

- Phase planning;
- Preliminary tool KPI and design;
- Dissemination event - B4F Survey results at a HKCBEEES conference hosted by *Politécnico di Milano*;
- [Mission in Portugal 5 days] Case study selection;
- [Mission in Poland 5 days] Case study selection;

- Tool deviation marker, reverse application, and mathematical validation;
- 2023/2024 FCT call for IC&DT – writing and application of phase 3 – B4F balcony modules towards PEB (see below);
- End of embryo-project, and;
- Publication - selection of ISI/Scopus indexed journals, article preparation, writing and submission stage (within 6 months after projects end).

To respond effectively to the defined goals, we need an interdisciplinary yet comprehensive in architecture team, with the skills to work on multilevel optimization and be able to lay the groundwork for future research. The traced path points toward the technical development of a modular architectural addition - phase 3 Architectural Plug-in (part of the FCT IC&DT call) - in the form of a PEB balcony module that updates building design on a cost/performance ratio, scientifically supported by the phase 1 and 2 outcomes, as established by the EU 2030 milestone.

The preliminary design of phase 3 takes the concept explored by *Lacaton & Vassal* architects (e.g., 530 units in Blocks G, H, I, Grand Parc neighborhood in Bordeaux) and intends to raise its qualitative standards and add new capabilities. By extending the indoor living space to semi-private outdoor multi-purpose balconies, the authors unlock a wide range of possible activities which increase life quality. In this way, the team envisions phase 3 as a modular-based architectural solution that pushes the building toward PEB standards. By resorting to generative design structural optimization is possible to enhance its assembly phase under a cost-effective approach while improving the existing building's thermal and energy performance by incorporating passive and active design strategies (e.g., Solar RES gathering, wind deflection, shadowing).

PS: Due to the template constraints, providing an adequate list of references is not possible. The team will gladly provide it under request.

EXPECTED SCIENTIFIC RESULTS

In phase 1 – B4F Survey, the team expects to create an accurate picture of the key design features and activities that a home balcony should present in the "new" era, supported by future architects' perspectives.

In phase 2 – B4F Tool, the expectations are higher. The tool will assist architects and designers in selecting the highest impact features from a user's perspective and rate a balcony context and its viability by assessing multiple surrounding conditions. Plus, it will allow to appraise the balcony value from a real estate perspective, help local entities to assess urban architectural quality, or even be part of a building sustainability certification (LEED or similar).

Furthermore, resorting to the FA-UL and FA-WUT scientific networking, the team foresees future partnerships with *the Politécnico di Milano* and the Faculty of Architecture and the Built Environment - TU Delft, to adopt the same methodology and confirm the tendency among other European territories.

BUDGET: € 7.500,00

The study goals require Research Center's financial support for the following activities:

- Measuring instruments, hardware, and software acquisition on data gathering, analysis, and reverse application — phases 1 and 2. (1900€)
- Lisbon and Warsaw missions — a minimum of two members interchange for fieldwork, rating tool reverse application and validation, and scientific coordination of the scheduled tasks, including phase 2 preparation; the results will design the 2023/2024 FCT IC&DT submission. (3600€)
- Knowledge dissemination — scientific event co-organization and open access publication charges (APC - Scopus/Elsevier). The authors aim to disseminate the research outcomes by publishing in ISI/Scopus indexed journal. Additionally, the team intends to promote the gathered knowledge at a broader event in collaboration with the Hong Kong Chemical, Biological & Environmental Engineering Society (HKCBEEES), preferably hosted by *Politecnico di Milano*. (2000€).