

## **FILL THE GAP[S]: DIGITAL SIMULATION TO FACE THE POST-BUBBLE CHALLENGE**

**Is it possible to define, through the use of simulation tools, a methodology of visualization of the degree of "renting" of the existing empty housing stock to link it with the satisfaction of the residential demands of citizens, according to the parameters that characterized the different actors involved in the housing process?**

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### **Brief:**

There is no doubt that one of the biggest challenges for urban planning nowadays has to do with the reuse of the vacant housing stock that exists in lots of cities and towns around us. Spain is one of the European countries with the highest percentage of empty houses, and in parallel with major problems to ensure the access to housing to the population. So, the solutions for this problem necessarily involves the definition of strategies to put in use the empty houses as the first resource to satisfy the demands of citizens.

The problem arises when this challenge is considered as a global phenomenon. We talk about empty housing under statistical parameters instead of making an approach to the problem from the specific study of the existing housing stock in each municipality. Just the definition of the characteristics of the empty houses, the causes of which they remain empty, and their degree of "renting", as a parameter that express the facility to put them in use, will be able to evaluate the best strategies to act on them and offer an answer to the specific demands in each case.

The broad knowledge of the under-used stock characteristics - the location, age, estate of conservation, tenure, or causes that remain them unoccupied - as well as the information about applicants of houses, about their residential needs and access capabilities, will be the key to reach our purpose, being necessary for that to manage large amounts of information, from different nature and source, in a process that further simplifications must seek complex solutions.

At that point it will be necessary to incorporate to the study of the phenomenon of empty housing the use of modeling and simulation tools, able to link the characteristics of different actors involved in the housing process (applicants, owners, technicians, social entities, administration), as a methodology needed to understand the dynamics generated between them to settle down the basis for the development of subsequent phases of decision in the residential planning.

In this context the aim of this proposal will be to analyze how the incorporation of multi-agent simulation tools to the process of linking the vacant dwellings and residential demands will allow to visualize the degree of "renting" of the existing empty housing stock at the local field, to establish further strategies to solve the social challenge of access to housing by putting them in use.

## **ODD Protocol:**

### **1. PURPOSE**

The aim of the model will be to simulate the process of put in use of empty housing and satisfaction of residential demands with the participation of the different elements involved, to determine the variation of the percentage of vacant houses over the time, to relate the maximum and minimum peaks with the factors that cause them.

### **2. ENTITIES, VARIABLES AND SCALES**

The model will consist of patches, global variables and agents, which are defined as:

#### **PATCHES**

We will define three kind of patches, depending on the use of ground according to urban classifications:

1. RESIDENTIAL
2. PUBLIC SPACE
3. COMMERCIAL

All the houses defined in the model will be linked to residential patches, being defined as: 1 residential patch = 1 house

We will assign a characteristic to the patches, which will be the "environment condition" linked to the degree of attraction of a house for applicants depending on the kind of patches around it:

Environment condition:

0. All patches around are residential
1. All patches around are public space
2. All patches around are commercial
3. Patches around are a mix of residential/public space/commercial

#### **AGENTS**

We will define two different agents in the model; Houses and Applicants (demand). The variables that characterize these agents are:

##### **HOUSE:**

Occupied: Yes / No

State of conservation: Good / Bad / Regular

Age: 0 (<5 years) / 1 (5-25 years) / 2 (25-50 years) / 3 (> 50 years)

Price: High / Medium / Low

Capacity: 1-6 people

The owner of the house will be an attribute of the house, with its own attributes, which will be linked to characteristics of the applicant desired by the owner.

Laboral status desired: Unemployed / Student / Employed

Age desired: Young / Adult / Elderly

##### **APPLICANT:**

Has a house?: Yes / No

Environment condition: 0/1/2/3

State of conservation searched: Good / Bad / Regular

Budget: High / Medium / Low

Age of applicant: Young / Adult / Elderly

Members of the family: (1-6)

Employment status: Unemployed / Student / Employed

##### **GLOBAL VARIABLE:**

Finally we will define a Global Variable, which will be assumed by the government, which will be characterized by its help to applicants to access to housing.

##### **GOVERNMENT**

Guarantor of access to housing (by specific policies): Yes / No

available funds: High / Medium / Low

Scale of assignation (for the rent of applicants): low / medium / high income

Scale aid groups (for the age of applicants): Young / Adult / Elderly

The model is developed temporarily in TICKS. Each one is equivalent to one year, which is the time that is considered appropriate to ensure minimum stability for an applicant to rent a house. That time also correspond to a reasonable period of time to consider changes in the

state of the building, which will influence in the price by the increase of the age. It will be a period, as well, that will consider the changes in the available funds of the government.

### 3. SUMMARY OF PROCESS AND PLANNING (SCHEDULE)

First of all we will define the action of every agent of the process:

- The action taken by the applicant will be to seek for a house to be rented according to its demands and characteristics.
- The action of houses will be to be occupied, by its characteristics or by the action of the owner that will look for the economic benefit of renting its house.
- The action of the government will be to provide help to the applicants to access to housing.

The point of start of the modeling process will be defined by the appearance of empty houses and applicants. From that point the first action taken by the applicants will be to occupy the houses that link with their demands directly (EASY RENTING)

- Houses that have a lower or equal price than their budgets.
- Houses that have a higher or equal state of conservation than searched.
- Houses that have a greater or equal capacity than the number of people in the household.

From that point the following steps will be linked to the action of the owners and the government, just when the conditions for the "easy renting" are not satisfied:

- Negotiation between owners and applicants to guarantee the occupation of houses (DIFFICULT RENTING). In this step we can define two situations:

1. The applicant is employed and the state of conservation of the house is higher or equal than the applicant's search. The owner will bring the price down 1 level.
2. The applicant is unemployed but could get funds from the government, and the state of conservation of the house is higher or equal than the applicant's search. The owner will bring the price down 1 level.

- Provide help to the applicants from the government (RENTING WITH HELP). When it is not possible the "easy" or "difficult renting", the conditions to get help from the government will be to have available funds and that the applicant's characteristics link with the conditions of assignment.

Over the time the state of conservation and age of houses will change, as well as their quality and value. The age of applicants and employment situation will change too. At the same time the government conditions will change, providing or not support to applicants, and so the model will change too.

### 4. DESIGN CONCEPTS:

The basic theory that this model and simulation is trying to support is that the convergence among all the agents involved in the housing process will, despite the limitations of either agents, ensure the occupation of empty houses and satisfaction of the needs of the demand under a system stable over the time.

As a strategy to develop the model we will establish the causes that are determining factors to guarantee the occupation of empty houses as variables of the different agents of the process, as well as the relationships established between them.

The system will initially be defined by five stages of work in the different scales of relationship between those agents involved in the process. These stages are:

1. Management of administrative data from social sources.
2. Incorporation of information about empty housing (visit, inspection) and housing applicants (survey, interview) as the first step to locate potentially "renting" houses.
3. Inclusion of data about potentially "renting" housing owners.

4. Definition of the degree of "renting" of existing empty houses, according to the data acquired in previous steps.

5. Definition of management strategies to put in use empty housing.

Thus the characteristics of applicants will be linked to vacant dwellings in a first step, with the owners appearing in the negotiation with the applicants when, for their conditions, it is necessary. The guarantee that applicants can offer to owners will have to do with their employment situation, economic status, or the capability to get support from the government, acting according to its budget capacity and political will.

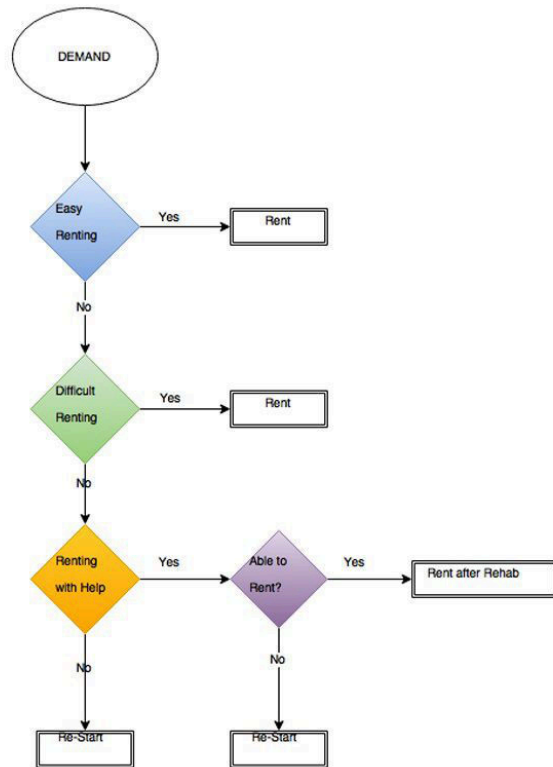
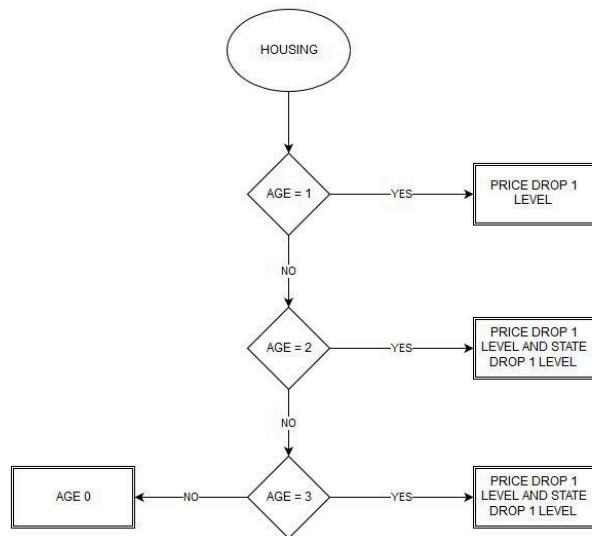
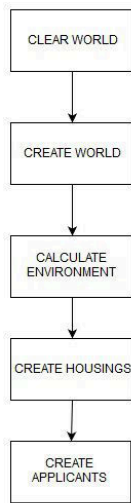
The model will try to visualize the degree of "renting" of empty housing, defined as the factor that will link the degree of facility of renting a house and the degree of stable guarantee for the applicant. Under this idea we will define as degree of "renting" level 1 (DR1), those cases in which we have "easy renting" houses with applicants that remain in them over the time. The rate of this degree will have a lower level (DR2) linked to houses occupied in later steps of the process ("difficult renting" or "renting with help") and applicants that can not remain in those houses for a stable period of time. The lowest level of the degree of "renting" (DR3) will be linked to houses that can not be occupied in the process.

#### 5. INITIALIZATION

In its initial state the model is composed of a distribution of patches of residential, public space and commercial use, randomly distributed. Each residential patch contains a house while in public spaces appear applicants waiting for the process of occupation of empty housing to start.

In the initial version of the model the physical environment will be abstract and following the description given previously. In a second version of the model, it was improved by incorporating a PNG file corresponding to a real sector of the municipality under study. Linking three assigned colors to the plots represented in it, the different type of patches; residential, public space or commercial, are located and distributed in a spatial way.

**Flow chart:**



**Code:** N3\_code.zip

View it on Github: <https://github.com/culturadigital/forma15/blob/master/N3.nlogo>

### Model snapshots:

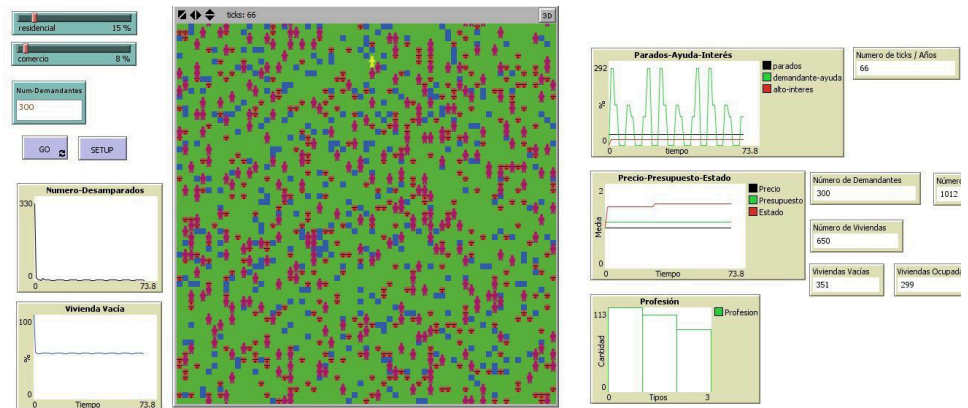


Fig. 1: Initial state. Initial version of the model

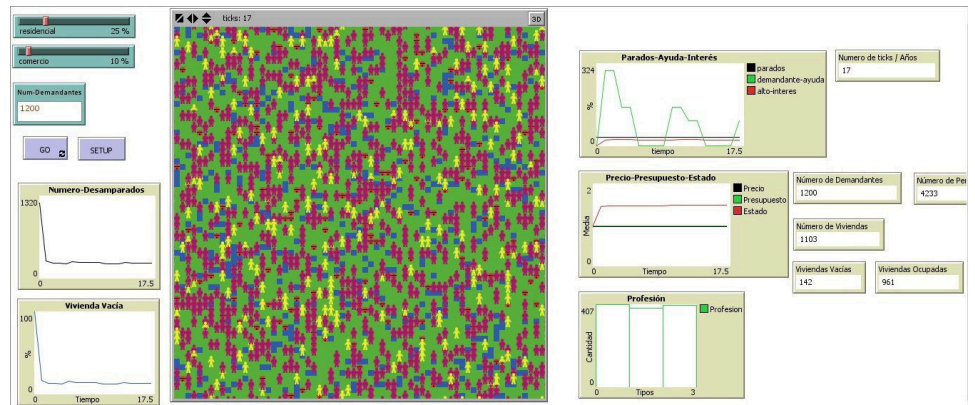


Fig. 2: State in process. Initial version of the model

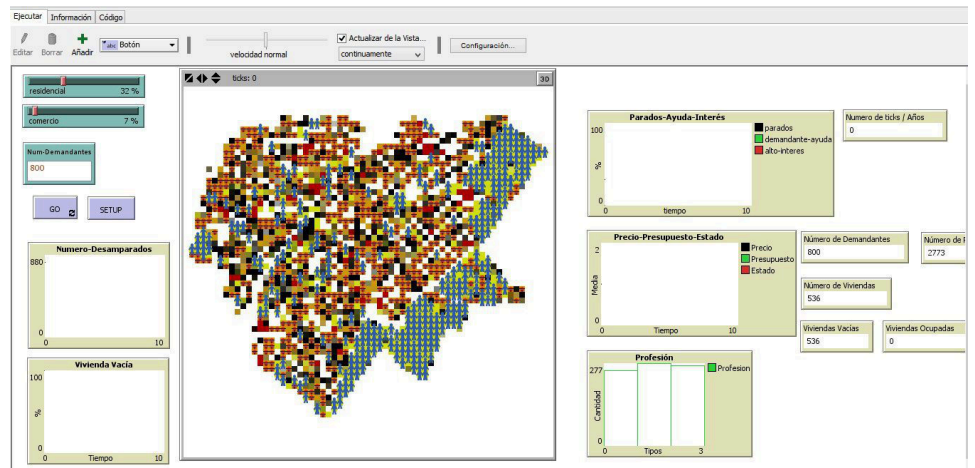


Fig. 3: Initial state. Version 2 of model with spatial distribution as real plane

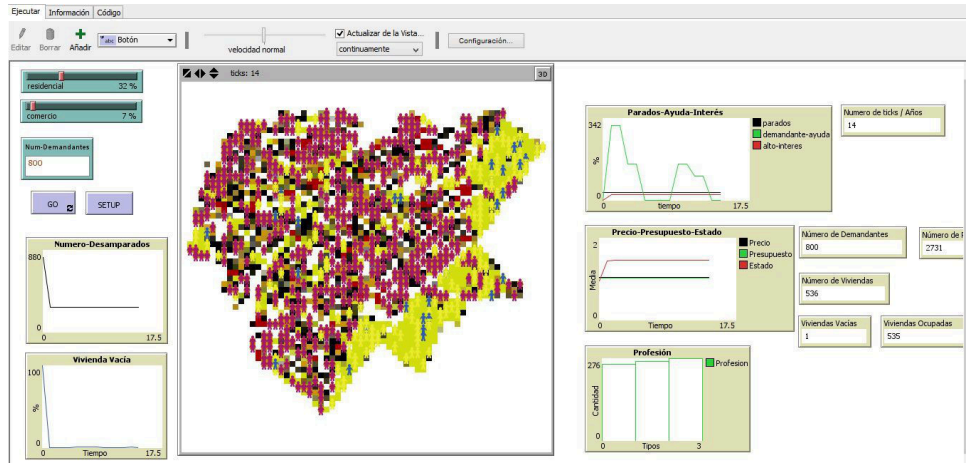


Fig. 4: State in process. Version 2 of model with spatial distribution as real plane

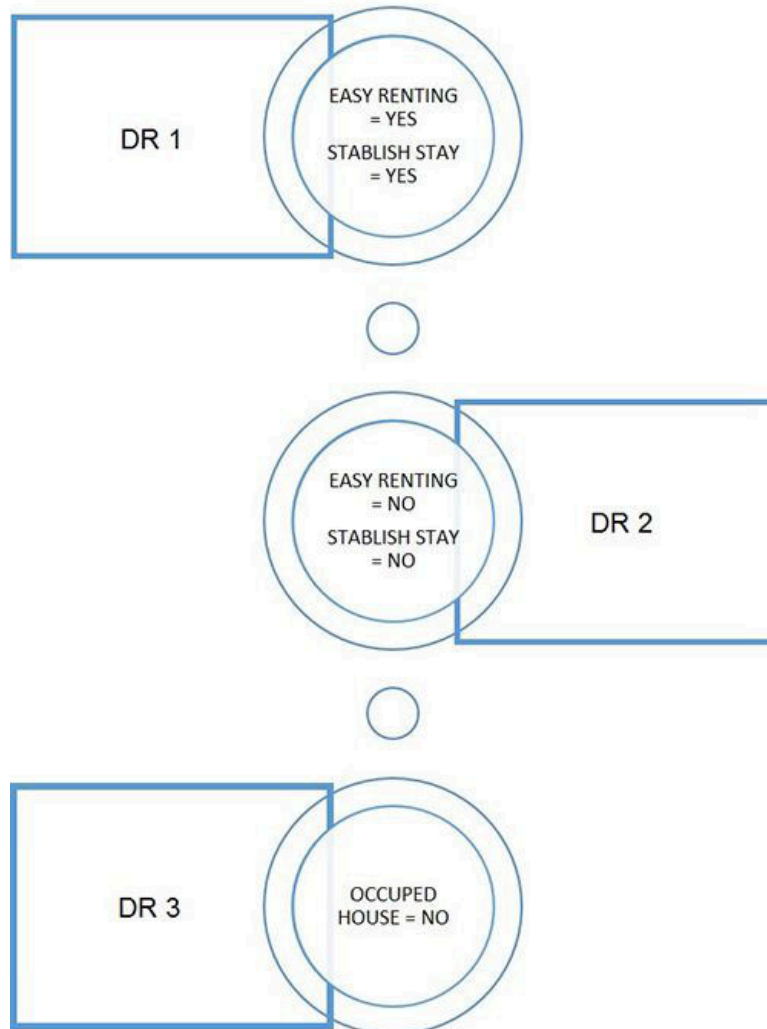


Fig. 5: Diagram degree of "renting"



## Conclusions:

As conclusions of the work developed during the workshop, as a collective process, and from the specific results given by the model, we will evaluate the results attending to three points of view:

1. The benefits of the workshop process for the research and the topic proposed: First of all we will talk about these items that, being part of the original proposal, was necessary to "re-thinking" from a multidisciplinary group perspective, and how these new definitions bring to the research a richer point of view. The specific definition of who the agents are, their actions, variables and relationships, and the translation of these concepts to a different language supposed new ways of thinking that helped us to understand the system, as well as the aids of the model we were searching.

2. The specific information given by the model and the simulation developed: After thinking about all the elements involved in making the system works, the results given by the model bring to the research answers through the simulation and the graphics linked to it. In this case, we can determinate how the percentage of empty houses and applicants vary over the time, how the maximum peaks are related to the worst employment situation of applicants and periods of time without help of the government, and how the changes of the age of houses affects to the state of conservation and prices.

3. The keys to work in the future in a more complex model: After this first approach to the multi-agent simulation tools, it will be necessary to keep on working in a more complex system able to incorporate agents and variables ignored in this first step, to reach more specific results. In this way, and after incorporating this new complexity to the model, there are several ideas drawn as conclusions during the workshop that will be future lines of work:

a. Represent in the model previous periods of time to evaluate how the results obtained can link with the real situation lived, as a way of validating the model.

b. After defining the meaning of degree of "renting" in the model, and with the first approach to the spatial view of the results in a real map, we will define in a geographical way this degree of "renting" in a complex model, to determinate which parts of the city are in a best position to be occupied.

## References:

- "From empty properties to new homes. Council's Empty Home Strategies". Stratford-On-Avon District Council. [https://www.stratford.gov.uk/...](https://www.stratford.gov.uk/)
- "Estudio del número de vivienda vacía en Andoain". Amaia Lujambio. Departamento de servicios sociales del ayuntamiento de Andoain. <https://jonpelaez.files.wordpress.com/...pdf>
- "Guía-modelo para la elaboración de planes municipales de vivienda y suelo". La junta de Andalucía lanza esta iniciativa vinculada al plan marco de vivienda, según el cual serán los municipios quienes, a través de esta figura de planeamiento, realizarán el análisis de su parque de vivienda y necesidades y demandas para, adoptar las medidas necesarias para atenderlas. <http://www.juntadeandalucia.es/fomentoyvivienda/...>
- 596 ACRES. Proyecto desarrollado en Nueva York, dirigido a visibilizar la enorme cantidad de espacio disponible y sin uso que podría ofrecerse como nuevos espacios libre y zonas verdes comunitarias en barrios donde escasean. Presentan una primera etapa de mapeo, catalogación y posterior apropiación, poniendo en relación estos espacios con las necesidades de las comunidades interesadas en su puesta en uso. <http://596acres.org/es>
- [IM]POSSIBLE LIVING. El objetivo de esta iniciativa desarrollada en Italia es visibilizar los edificios infrautilizados que puedan ser susceptible de un uso más intensivo, definiendo para ellos diferentes categorías según su uso previo, propiedad, características, para catalizar procesos de colaboración entre personas y colectivos que quieran dar soluciones creativas. <http://www.impossibleliving.com>