Image Tagging and Gearing Resources Applied to Students' Graphic Materials

Learning techniques in pursuit of inclusiveness for urban and landscape design

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Abstract

Inclusiveness can be considered a requirement for contemporary statements in urban and landscape design referring to age, condition, gender or nature. But how is inclusiveness influenced by spatial design? Can this relation be measured or proven? And more precisely, which interactions are considered across different generations or between human and non-human agents?

This paper describes student's work evaluation procedures through a methodology consisting of selecting picture-based content from initial reference materials provided by teaching staff, as well as graphic material designed and produced by the students, to further analyze these through data visualization techniques and the production of info-graphics. In a latter step, a gearing game – which is a type of sociogram used to understand agents and matters of interest – is utilized to drive a discussion about design statements for further stages of development concerning students' design projects. The first stages of the methodology are strongly influenced by how the students perceive elements from reference materials and represent these in their own design productions. A literature review further investigates the dichotomy between representation and perception, and the generation of subjective images.

As a final consideration, this work aims to create combined methodologies by incorporating participatory observation methods (e.g. photovoice and flow charts) from the social sciences into urban and landscape design, as they are understood through an accurate design of the learning experience. Similarly, non-representational design and dataviz diagrams from urban and landscape design could potentially be implemented in the teaching of social sciences.

KEYWORDS

perception, participatory planning, image tagging, non-representational, transdisciplinary

1. Introduction

This paper describes a joint methodology based upon the intersection of two research strands, inspired by and referring to (1) participatory and (2) observational methods. As can be seen in Figure 1, observational as well as participatory methods are deployed to achieve specific goals through the utilization of tools and techniques of data management and visualization.

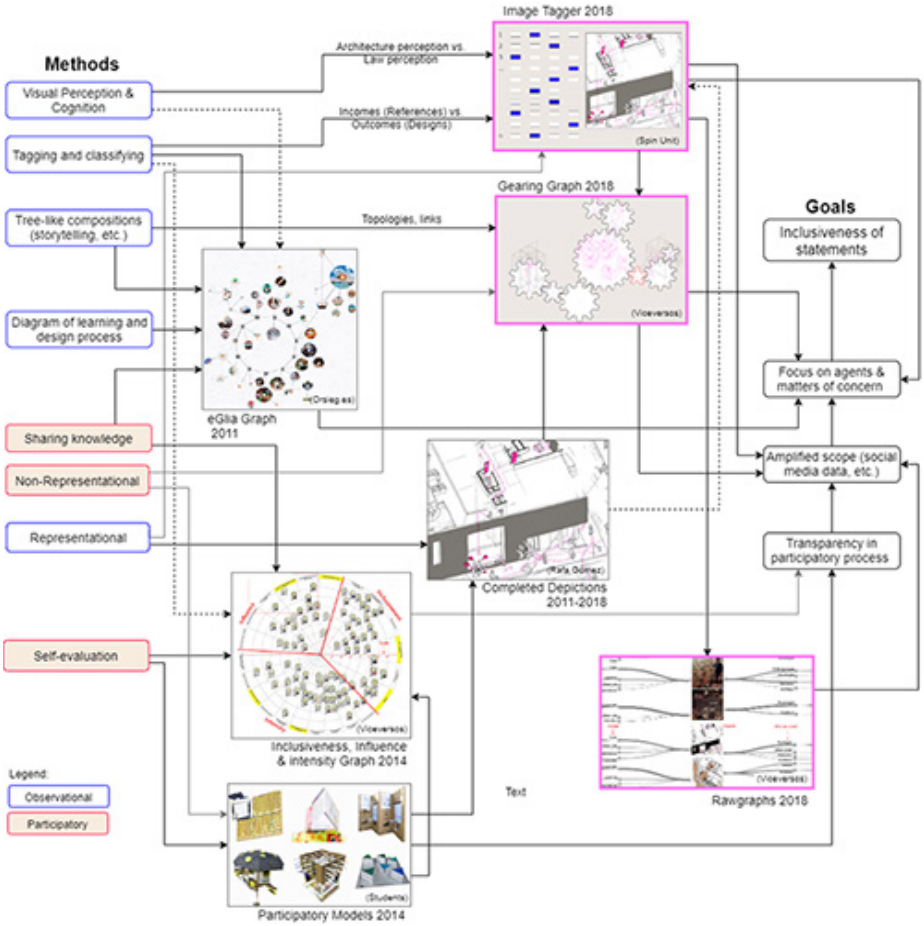

Figure 1. Diagram of methods, resources and goals. Classified into observational and participatory resources, methods are ordered in time (source: author).

As the original definition of participatory methods is to get experts involved to community debates as a way to understand how stakeholders successfully resolve planning issues (Cook 2005, p. 167), this paper presents an academic interpretation of those methods by considering resources that allow us to disseminate the authorship of design decisions. Following this discourse

and assuming that observational methods enhance decision-making by investigating controversies from the outside without being actively involved in them, the aforementioned academic interpretation utilizes various means of categorizing problems through visual recognition and perception.

In this context, the first mentioned research strand follows methods under the umbrella of non-representational techniques, whereas the second uses representational procedures. Interestingly, both of these academic domains, when applied to an urban and landscape design framework, aim for inclusiveness by avoiding segregation through design principles. They attempt to prove the evidence of an environment inhabited by more than human entities alone, an environment which seeks to show and label itself through a progressively more open and transparent representation. Over the past years, these conceptual methodologies have been gradually deployed in architecture and urban design studios – and especially in emerging schools – raising discussions and controversies on how to approach inclusive design through educational procedures (Gisbert 2016; Carrasco & Abellán 2015).

The methods presented in this paper were implemented in an evaluation of design statements and overall targets in Urban and Landscape Design Units at the University of Alicante. Two main topics were addressed, one focusing on human/non-human interactions and the other on inter-generational design Both deal with inclusiveness through spatial design.

2. Methodologies

2.1 On participatory methods

While one of the fundamental goals of the natural and social sciences is to generate in-depth knowledge of an environmental reality, participatory methods complement a similar approach to the definition of natural or social ecosystems by adding the final goal of realizing inclusiveness in decision-making processes (Kesby et al. 2005; Francés 2016). With a non-rigid structure of data collection and a non-hierarchical (horizontal) communication structure, most ways of performing participatory techniques make use of non-representational methodologies, which encompass relational multiplicities by reinforcing their narrative and intangible values.

"Our self-evidently more-than-human, more-than-textual, multi-sensual worlds (…) a mosaic of theoretical ideas borrowed from fields as different as performance studies, material culture studies, cultural studies, the sociology of the body and emotions, and the sociology and anthropology of the senses." (Vannini 2015, p. 3).

As examples of participatory tools, we can name collective mapping, handcrafted models as well as testing instruments in which actors themselves decide which scale or stakeholders to work with. These devices have been described as "something instrumental: a technical artifact for articu-

lating some difference between world and thinking" (McCormack 2015, p. 94) and follow some of the design methods carried out by pioneering architects in facilitation processes, such as Simone and Lucien Kroll in the last decades of the 20th Century (Bouchain 2013, p. 117).

2.2 On observational methods

Several scholars acknowledge the close relation between the perception of physical elements or spaces and the representation of these (Jakob 2016; López Baeza et al. 2016). The perception process integrates a system in which physical reality is experienced subjectively and incorporated to the subject's system of interpretations. Single components of physical space and objects are merged with subjective elements such as memories, feelings, education and personal background to be associated with existing concepts learnt in advance (Jakob 2016). As one intends to represent something previously perceived, the process is similar. The main narrative of the element to be represented is decomposed into individual concepts, and a story is told through them. For example, when someone perceives a house, they first acknowledge the house as a whole concept before subsequently focusing on individual elements and details; in contrast, when someone represents a house, they first draw the roof, the windows, the doors, the chimney, etc., before these individual elements are consolidated into the representation of the concept as a whole. Applying a similar approach to urban space, Lynch (1960) defines the concept of *environmental image* to explain perception through a cognitive approach, where elements such as readability, comfort and the personal background of the perceiving subject come into play (López Baeza et al. 2016). This environmental image is generated by two main elements; the first is a perceived image of a physical form (e.g. a boulevard) and the second is the contextualization of the self in relation to that (e.g. a boulevard perceived as the boundary of the home neighborhood).

Research on how people perceive space has always been a key topic in urban and landscape research. Cognitive processes consider observational methods that relate the perception of elements with social behaviour driven by stimuli-context-response internal relations, which are adaptive and respond to evolving urban conditions (Hou et al. 2014).

As described above, the strong linkage between the perception and representation of concepts allows us to deepen our consideration of the former through the taxonomy of the latter. Thanks to the second strand of research, which refers to database analysis instruments such as media content or digital images, we are able to subsequently translate results to produce diagrams for further study and interpretation. A key step is the early transferral of represented elements (i.e. images) into a list of parameters and options, "valuable because they afford a way of going beyond the conventions of certain

kinds of representations" (McCormack 2015, p. 95) in order to be managed and analyzed as data.

Addressing both participatory and observational methods, our intention is to follow the discourse of Anderson and Ash (2015) on *backgrounds of thought and life* to focus on the affective, embodied conditions for representational acts and practices, labeling these spaces *affective atmospheres*. To portray this phenomenon, Anderson and Ash (2015) take account of anxiety and other internal feelings related to the perception of environment along with its way of being manifested in situations of daily life such as patients in a hospital waiting for doctor's attention. In this sense, methodologies are a way of giving visibility to components of such specific situations.

3. Resources and tools

This exploratory research is based on two main resources related to participatory and observational approaches, namely a tree-like gearing graph and a software-based tool to tag and interpret images.

3.1 Tree-like Gearing Graph

Here a set of rotating gears is utilized to depict and explain the sociological nature of a given design context (see Figures 7 and 8). This works as a collection of mobile objects to display arrangements of solid bases on which to place agent models or stakeholder drawings. The number of agents can be increased and the origin of the arrangement can be established with relation to a specific narrative coherence. The whole assembly can be synchronized to support a design statement and its expected performance.

This model provides a simplified representation of a complex relational-network system by means of a tree topology, featuring simple cause-effect relationships and first-order bifurcations. The system allows functions or roles to be assigned to each size of gear. Furthermore, single concepts can be assigned as *blocking* keys, preventing the rotation of the gears as a way of detecting potential major players in the represented system.

Previous displays using a similar typological approach are *eGlia* and *Inclusiveness, Influence and Intensity* graphs. The *eGlia* graph is an online tool used to compile and tag digital objects such as videos, photos, blogs, etc. as well as to display non-linear learning processes pertaining to the design work of a group of students during an academic semester (Hernández 2011) (Figure 2a). Through a tree-like deployment rising from a circle of attendees, each secondary node is a graphic object or hyperlink to another type of material, thereby providing external references. *eGlie* is named after *glia* or *neuroglia* cells, a specific type of nerve tissue that constitutes a matrix to support neural networks. Conceptualizing this process, *eGlia* aims to visualize how raw information is transferred across learning paths and among students, avoiding the

limitations of traditional forms of communication and documentation.

"During design workshops, storyboards, photographs, field studies, etc. allow tangible communication (...) but the outcomes and process of these workshops remain often inaccessible for people that do not partake" (Schoffelen, Huybrechts & Devisch 2019, p. 248).

The *Inclusiveness, Influence and Intensity* graph is used to analyze learning outcomes and order the collective production of a group of students over one semester (Carrasco et al. 2019) (Figure 2b). Its name is inspired by the indicators employed in the *Democracy Cube* graph (Fung 2006) along three scaled axes, although in this case each indicator has the same visual value: a portion or a circle. When students design private space able to induce some kind of communitarian benefit for a neighborhood, this graph expresses the veracity of *in situ* activities held to detect their needs and abilities. Through the use of this tool, students are able to publicly express their opinions about each other's work, and suggest which is the most successful. Radially scaled inside out, some designs proved successful under specific parameters, whereas others had no visibility. All in all, these dynamic methodologies are able to compile opinions about complex questions such as the ability to design processes or to express how stakeholders understand assessment.

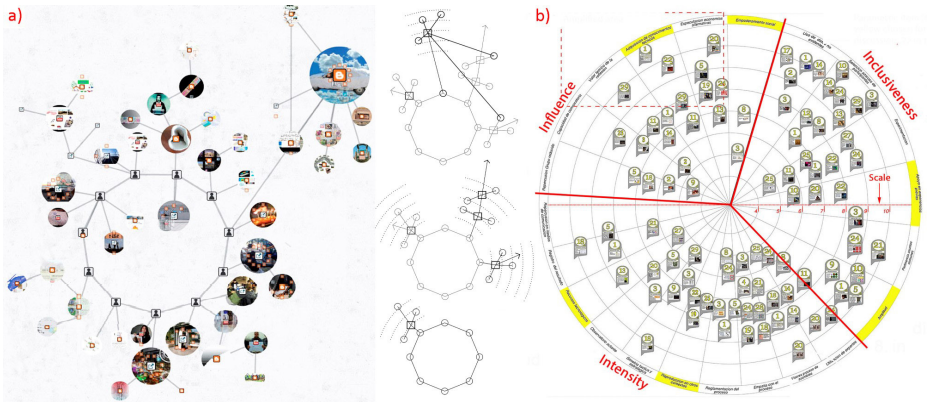

Figure 2. An *eGlia* graph: **[a]** Set of participants in central circle, personal & team production extend radially (design and code: Sergi Hernández Carretero, 2011); **[b]** *Influence, Inclusiveness & Intensity* graph to evaluate the collective production over the semester (performed at Design Unit Antonio Abellán & José Carrasco, 2014).

Figure 3. [a] Sample of images selected from reference materials; and **[b]** graphic material produced by students (source: author).

3.2 Image-tagging software

The second main resource utilized in this research is *ImageTagger*, a tool developed by SPIN Unit to help interpret graphic content on online posts. It creates a string-based dataframe in which metadata is linked to pictures by manually tagging an interpretation of their content. In our case, images were tagged by mixed groups of architecture and law students. Images were taken from graphic material produced by students (*design projects*) as well as from references given to them at the beginning of the semester (*references*). Samples from both topics – inter-generational and human/non-human relations – were considered.

Figure 4. Tagger interface, digital tool developed by Spin Unit (source: López Baeza et al. 2018; image sample: Rafael Gómez Durán, student).

Tags are based on a pre-defined matrix of parameters and values so that each parameter can be associated with a chosen value (e.g. parameter 'size', value 'small'). The software records the choices and links them to the corresponding picture. In a later step, parameters and values (tags) are merged with a picture's metadata. Figure 4 shows the tagger interface, displaying a set of parameters (rows of buttons) and values (every individual button) which are manually associated to the displayed picture by clicking the buttons.

Previous research based on picture tagging has been performed in several disciplines in the intersection between social science, computer science and urban studies (e.g. Döring, Reif & Poeschl 2016; Cheng et al. 2011; Gibbs et al. 2015; Park et al. 2014). More specifically in the study of urban space, López Baeza et al. (2016) examined the individual valuation and shared perception of a newly remodeled street through Instagram pictures; further, Cerrone et al. (2015) performed a comparative study of pictures taken in diverse urban fabrics in several Baltic cities to conclude a correspondence between morphology, behavioural patterns and representational trends.

Statistical data can be transferred to a sociogram, a two-dimensional graphical image of relationships between stakeholders or concepts by means of cause-effect chains (Francés 2016) to portray qualitative tendencies and enable further interpretation.

4. Results

As a result of the implementation of the resources described in both observational and participatory methodologies, Figure 1 shows how graphic standards and original resources were produced over time to achieve the ultimate goal of accomplishing inclusive urban and landscape design. One can observe how depictions of land for which designs have been agreed were accompanied by years of participatory techniques. Linear links indicate sequences and branches in this kind of evolutionary process. Techniques can be organized in representational and non-representational categories. The ability to identify agents and matters of interest is as valuable as the ability to create stories in support of statements.

Students tagged fifty images grouped into two topics, namely inter-ageing and human/non-human relations. Subsequently, they used the tree-like gearing device as a vehicle to express possibilities on the combination of agents in order to communicate a possible statement of design. Categories and selected values helped to orientate discourses. As complementary material, info-graphics were developed using data visualization software.

The results obtained from the image-tagger software reveal that images tend to refer to prospective situations (design projects) of living conditions between humans, non-humans, architectures, technologies and goods. A set of results pointed towards a special focus on the comparison between "Link-

age", "Handling", "Technology" or "Common Space" (Figures 5 and 6). The sense of these categories links into the concept of inclusiveness through "the degree to which we feel at home in a place, and that is not just a function of who we know in that place, but how we know it, what we experience in it, and the degree to which our memories and narratives are associated with its natural and built environment" (Parkinson, 2012:173).

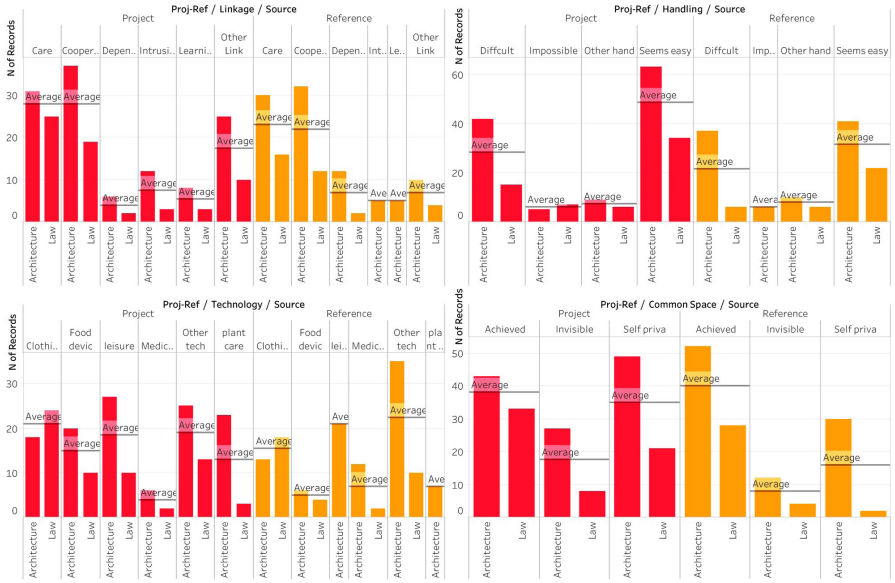

Figure 5. Bar charts for some evaluated parameters: Linkage, Handling, Technology and Common Space. Reference materials (orange) and production design (red) (source: author).

Differences regarding the educational background of the students were detected in the results, specifically whether they belonged to the faculty of architecture or law. In particular, law students were more likely than architecture students to tag one picture with the same values for every parameter. The results from architecture students tended to be more diverse, whereas law students selected the same tags for every picture, showing a higher perceptive cohesion. Furthermore, Figure 5 shows how each pair of bar graphs reveal a strong proportional relationship when observing the provenance of the pictures. This indicates that architecture students understood and included the materials presented as *References* at the beginning of the course, and incorporated their narratives and concepts when developing their own work (*Reference*: orange and *Design projects*: red).

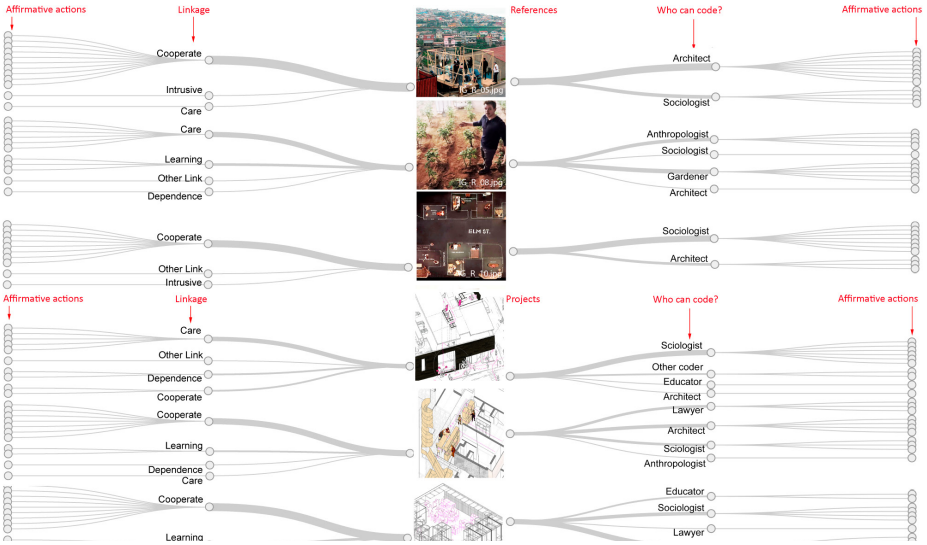

Figure 6. Sample of Tagger results through a horizontal dendrograph – *reference materials* (orange) + *production design* (red) (source: author).

A dendrograph visualization was extracted to represent clear topological links between parameters, using horizontal tree-like topologies (Figure 6). Subsequently, and moving up to a higher level of complexity in device design, a tree-like gearing physical graph (Figure 7) was used to illustrate further concept relations. One special focus was to consider how ethics of care have evolved towards new forms of cohesion and reciprocity for a specific situation: e.g. the sociability detected in *Princesas* (Leon de Aranoa & Roures 2005) taken as a framework in which one could observe ethics of care through decision-making for an interior design refurbishment of a building inhabited by elderly and young people. In this case, gears were the proper bearing to set small models expressing daily care technologies. Affective bonds across generations or between objects and humans – over disaffection or intrusion – were incorporated through modular technologies. Speculation regarding the arrangement of gears let the students practice different ways of explaining designs with a strong narrative and *performative* component.

After compiling and interpreting the results, it became clear that the tagging and gearing exercise in parallel with the design exercise helped to pinpoint the sociological and ecological possibilities of initial statements. Furthermore, statistical observations such as average values, tendencies and correspondences helped the students observe social variables from an applied-research perspective. By thinking in terms of categories and parameters (tags or gears), students were able to deconstruct underlying problems, decomposing these into elemental parts so that relevance on particular issues

could be highlighted as in a complex-systemic networked approach. The potential implementation of these methods with other social groups, in particular practitioners and stakeholders in participatory processes, could serve to *taxonomize* problems and provide a detailed, granular understanding of causes as well as the consequences of approaching them in different ways.

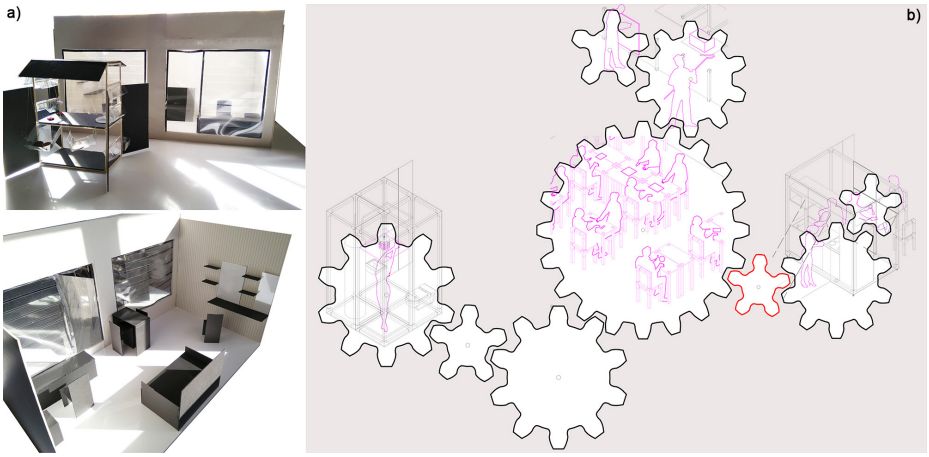

Figure 7. Gearing tool case study: refurbishment of an inter-generational dwelling (source: author).

Gearing depictions became samples of a non-representational methodology (Vannini 2015) since models portrayed complex relations with a stronger emotional and empathic component than Cartesian and Euclidean representations, thereby encompassing humans and non-humans such as things, objects, animals, physical forces and spiritual entities (Thrift 2008; Puig 2017) and proving that "life expands without any proper geometric definition" (Hasse 2011, p. 56) (Figure 8).

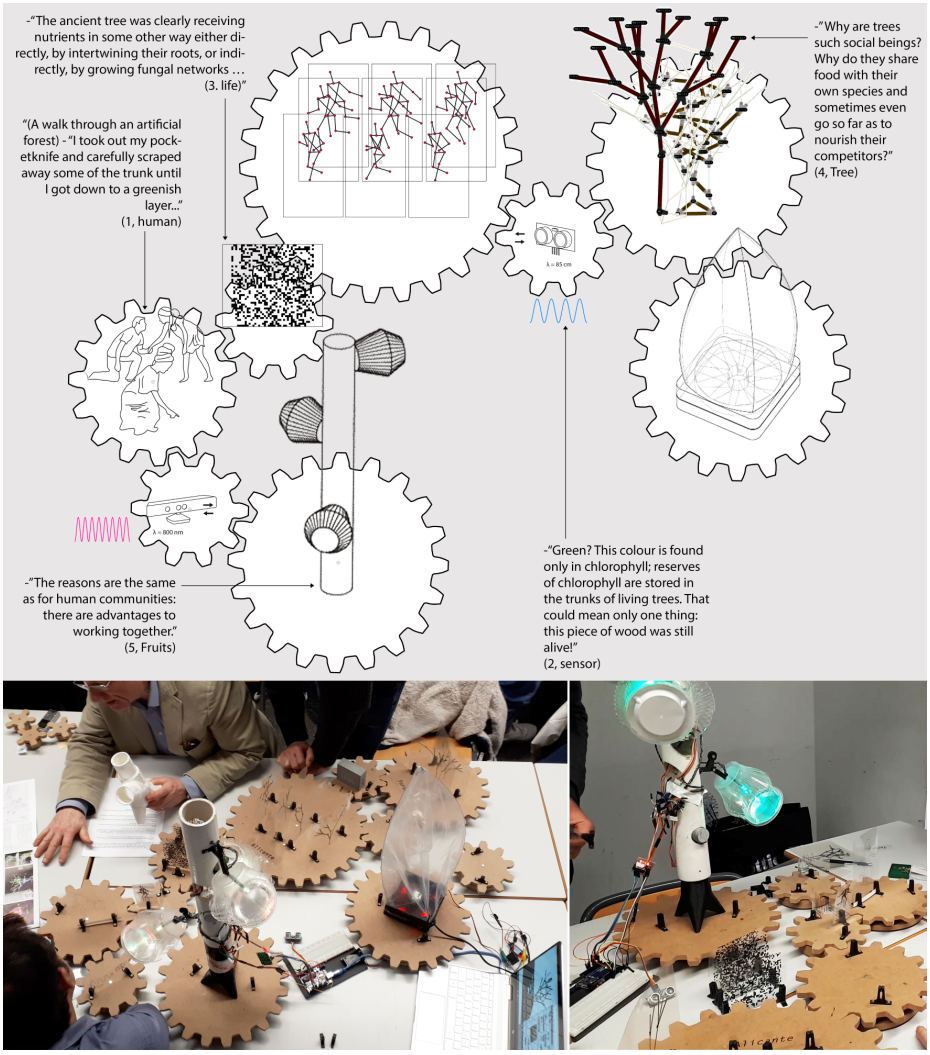

Figure 8. Gearing graph: *Landscape*. Synopsis: Trees communicate, share nutrients and protect themselves using symbiotic interactions. Fruit ripening has inputs such as pollination, human cares, wind & rain; and outputs such as texture, flavour or acidity. *Mise-en-scene* starts when a sensor detects visitors. Data is then taken to an interface where it is combined with a *game of life* model and produces a light & sound response; later, the physical component emulates how fruit ripens (created with the contribution of social anthropologist Tim Ingold, March 2018) (Gearing tool: José Carrasco, 2018).

5. Discussion and Conclusion

The two different research methodologies of participation and observation are compatible, fostering inclusiveness through the mapping of modern master solutions such as the Maison Medicale (Kroll) or the Diagoon (Hertzberger) in relation to concepts such as flexibility or adaptability (Ribot 2018). Furthermore, they are potentially compatible with other approaches such as engineering psychology dealing with the identification of design parameters by reading the spatial configuration through mobile eye tracking as a transversal and interdisciplinary approach combining technological, discursive and analytics skills.

Thanks to tagging and gearing devices, students could examine some possibilities of public and semi-public spaces to activate emotions and generate attachments (Till, Blundell & Petrescu 2005) using lists of items and models of representation rather than scale models, thereby highlighting equidistant and inclusive situations of coexistence between humans, non-humans and nature (Devish et al. 2019).

The representation-perception dichotomy helped us establish a framework according to which procedural decisions were taken. Manual tagging relies on interpretation, which involves a subjective component on the part of the researcher. In this work, a consistent method and training were implemented to reduce the research bias by establishing general criteria on the interpretation of pictures: parameters and variables were defined in advance, and each picture was tagged accordingly. This is commonly combined with a corpus of graphic content posted in public platforms such as social media, an approach often used in urban research under the umbrella of procedural urbanism with a greater social component. Following the post-modern discourse on cities as a set of individual perceptions, interactions and experiences (Lefebvre 1974; de Certeau 1984), social media data offers an up-to-date compilation of these in a manageable format (Manovich 2009).

The comparison of incomes (*References*) and the students' outcomes (*Design Projects*) performed through manual tagging emulated how machine-learning based image recognition is able to recognize content and classify images into categories. In our case, a human process required more time, manpower and expertise. Nevertheless, results from our manual tagging were more reliable than the mere identification of processed shapes by automated algorithms, since a human interpretation enabled the extraction of information on narratives, intentions and relations through the subjective interpretation of the person tagging.

During the work sessions, the tree-like gearing device became a dynamic tool to enhance conversation and discussion, helping to facilitate the "long-term engagements of users, citizens and participants" (Schoffelen, Huybrechts & Devisch 2019, p. 247). Its design generated a rather surprising move-

ment, which captured that attention of the participants.

These exercises have achieved transversal goals. Firstly, they proved the capacity of entity labeling, evocative and related to references, in the understanding that things are precise (referred to a place and time) and common (related to generic places, networks or events) (Anderson & Ash 2015). Secondly, they recognized that controversies can be plotted within boundaries to allow an ontological and spatial approach. Thirdly, they highlighted the importance of understanding the roles and degree of representation of the agents involved. Finally, they showed how representation is not merely textual or figural but a way of looking at minor entanglements in line with Probyn's approach, encapsulated as follows:

"The amazing, sometimes eventful, sometimes buoyant, sometimes endured, sometimes so sad, always a commonplace of becoming sentient to a world's work, bodies, rhythms, and ways of being in noise and light and space" (Probyn 2015, p. 73).

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