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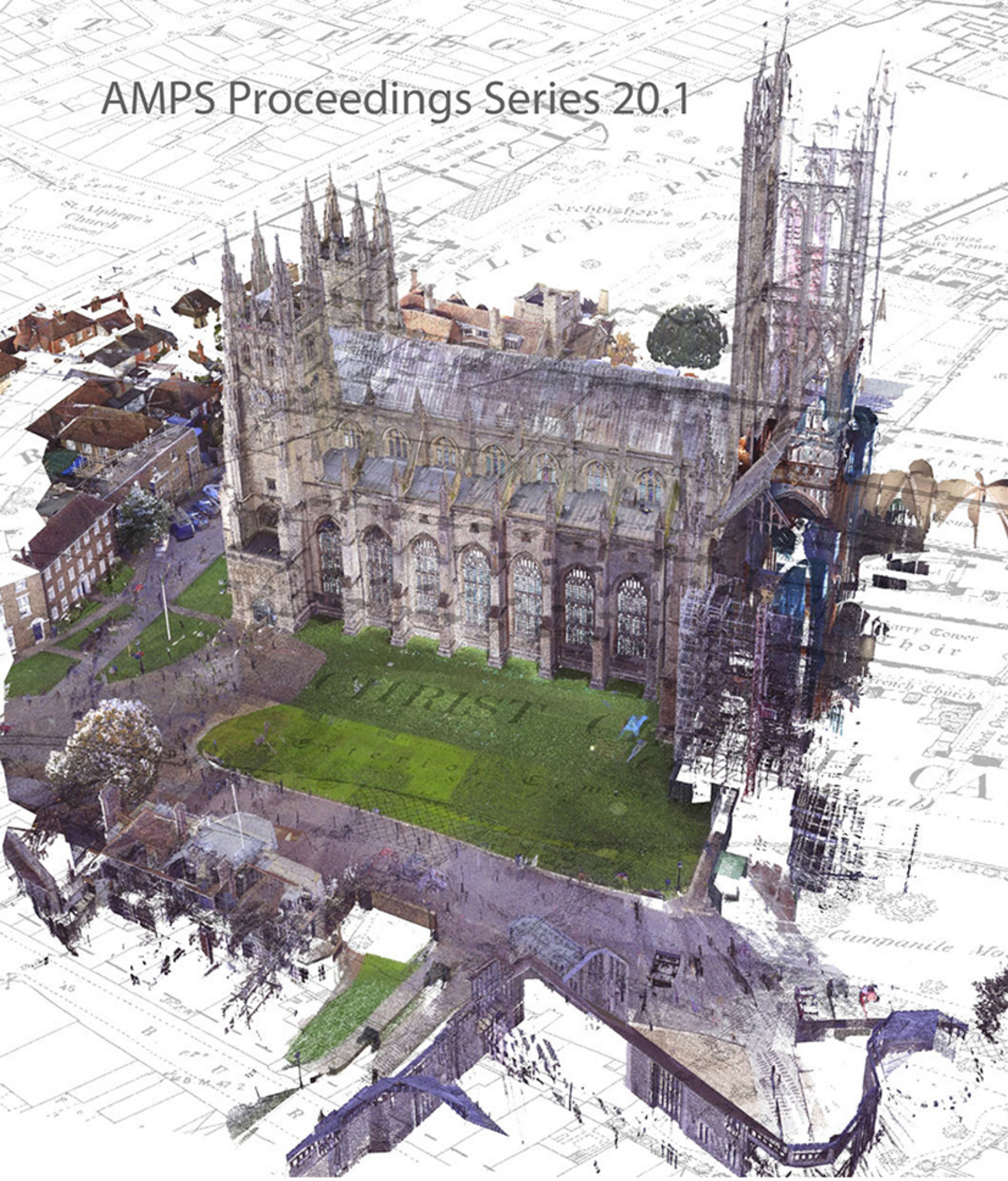

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NEW TOOLS, NEW THOUGHTS: ACTIVITY THEORY APPLIED TO THE ARCHITECTURE LEARNING FIELD

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INTRODUCTION

The appearance of writing is understood as a technological shift in human evolution. According to Jack Goody[1], orality and literacy produced different modifications in cognitive processes. The introduction of writing systems created a greater "abstract", which gave oral communication a form to evolve. Thus, it allowed to open up the critical perspective and consequently, the reasoning. In architecture, the introduction of drawing computing technologies in early learning processes, can also create new associated cognitive significances, due to the use of these new tools.

Writing has been seen as providing speech with an "objective correlation", without analysing in depth the existence of distinctive features for spoken and written languages; since it is more than just a skill, but rather a change in the capacity of the one who practices it and therefore, gives the mind a special kind of device over reality.

Like writing, the graphic representation of space is a tool that can produce changes in the visual spatial capacity, this can be perceived as differences in modes of thought, or visual thinking. This paper presents the architectural learning field, as a fruitful context within which learning can be understood as a dialectical process of social and individual transformation. Activity theory tries to give a theoretical tool and shed light on the effects of changing context in the architecture learning field, understood as the relations between people, tools and artefacts. Viewing learning as dynamic cultural processes which students are connected to, in the particular constellations of practice, can change the activities that are routinely done. Thus, this paper specifically focuses on the effects of change in architecture learning, whenever graphic representation tools adjust for different generations.

The article begins by outlining how activity theory helps to understand the importance of mediation between actors and their objects, often produced through technologies that our humanity has constituted[2]. Activity theory is then presented in further detail, specifically highlighting its dialectical concept of personal and social transformation. The article goes on to explain the relevance of this concept in the architecture learning field, where students live surrounded with new powerful tools that are shaping them. The methodology used in the research is shown, based on an approach sustained with qualitative anthropological techniques. Then, it is described by participants' educational contexts, embedding different activity systems that direct the nature of their practice. Findings relating to personal and social transformation are presented and, finally, corresponding conclusions are made.

THEORETICAL FRAMEWORK

Adopting activity theory as a key theoretical approach, that is to say, theory that allows a deeper understanding focusing on the human relationship with technology, will help present an insightful analysis of how changes in architectural learning field, force to rethink the way we teach architecture students to use and enhance visual thinking, paramount capacity to be an architect.

Essentially, rather than focusing on individual psychology or on social structures, activity theory takes the activity that occurs between people in social situations as its phenomena of interest and unit of analysis. The comprehensive understanding of human work is a central aim of activity theory. In our case, design activity involves the use of tools that change alongside time. Looking closely at the way design activity is mediated by this liquid modernity[3] and the ways in which individual agencies can be affected and therefore, broader the social and cultural change in the architecture learning field, as a consequence. Activity theory directs the attention to the learning of systems, not individuals, and so activity systems should be the unit of analysis. So, a multi-level framework of operations, actions, and activities that constitute learning work is fundamental in the set of concepts and ideas of this theoretical approach[4].

The practical and concrete units of learning through work that architecture students manage on a daily basis have changed, since activity systems evolve over time. Activity theory explains that in architecture learning, human action tends to form an object-oriented approach, focusing on objects for activities and on object motives. Activity theory allows to undertake a piece of work that is methodologically sophisticated, grounded in real-world activities and address issues of complexity, which are commonly put to one side, therefore it allows access to the complexity and dynamism of real-life scenarios[5]. Activity theory's capacity to work with the complexities of architecture education is one of the main reasons invoked, as it brings light to gaps and contradictions between different educational tools, directing participant's processes and outcomes of learning.

The main system of activity discussed here is the mentoring activity of architectural studio design in different contexts. Such a system entails the enactment of reflective discourse through graphic representation supplied by the student which directs the mentor's action towards promoting students. So, it is paramount to turn to the notion of context, understood as constituted through the enactment of an activity involving people and artefacts, since it involves specific objects and goals and, at the same time, specific settings. Therefore, this conception of context is a transformative relation between people, tools and artefacts[6].

Furthermore, discussion regarding the student designer thinking process' is thus needed. Psychologists[7] assert that humans use mental simulations to learn or create new thoughts. That way, it is so important to develop a well-trained visual thinking in architecture students, that is to say, the ability to think of mental images acquired through sensory experiences or generated in the imagination. This gives them enough skills to operate with a process of problem-solving that requires spatial strategies, rooted in the creation of new, useful design elements[8].

According to Mataix Sanjuan, Leon Robles and Reinoso Gordo[9], the activities most effective for training spatial abilities are those that require the student to adopt an active role. For instance, sketching is not regarded as a simple design tool, but a tool to develop a student's visual thinking because it is a vehicle to explore new forms, see encounters with existing elements and a way to analyse contextualisation and, as a result, generate balanced designs.

The preferential use of some tools over others, requires reflection on another cognitive process that is the internal working models, a concept born in human development field that states that patterns of relating acquired in the early parent-child relationship are internalized and form the basis for how an

individual enters and subsequently maintains other close relationships[10]. However, this paper intends to be understood as patterns of acting acquired in the early information technology relationship. This special approach to representation takes into account some degree of isomorphism between the working models and what they represent, a 'relation structure'[11].

METHODOLOGY

Through an ethno-historic study drawn on the life stories of four students of architecture and two lecturers of architectural design-studio carry out in a school of architecture located in Portugal, architecture students learned to gain understanding towards the main causes implicated in the learning process of architecture. The choice of this ethno-historic technique is based on three essential points: First, it allows gathering collective representations that include mental and emotional attitudes. Second, on the choices made by individuals or groups to resolve the crucial issues of the work, mixed decisions are made at individual and collective levels, consciously and unconsciously, socially and personally. Finally, both social solidarity and the conflicts of daily life are expressions of the interaction of the objective and the subjective[12].

On the other hand, participant-observation as a lecturer of architectural design studio for seven years has been a paramount technique. As Burawoy[13] says, when social scientists participate in their study, particularly in studying social change efforts, they are better able to interpret the meanings of what is said and written. At the same time, their observations and content analysis in the service of explanation provides the scientific dimension of this work. This professional experience allowed a close knowledge of the activities of agents. This allowed a deeper investigation of the complexity of the architectural learning field.

The paper will aim also to provide a schematic account of the interactions between actors and processes operating on diverse spatial scales and the ways in which these interactions ultimately crystallize into specific change in architecture learning field.

THE SCHOOL OF ARCHITECTURE

Escola Superior Gallaecia is a small-scale architecture and arts school in northern Portugal. It has a faculty of 18 members, of which 8 are in charge of the architectural studio design subjects of the Integrated Master in Architecture and Urbanism. In total, there are 10–architectural studio-design courses throughout the academic journey. The teaching of these courses always has the joint participation of two teachers to guarantee the diversity of approaches and not to limit student's explorations.

In general teaching, two activities take place simultaneously. On the one hand, what is known as the academic task environment (ATE), and on the other hand, there is the structure of social participation (SSP) in class, that is to say, the way in which the sequence and the articulation of the interaction govern[14].

In the case of teaching architectural studio-design, the structure of social participation is especially important in order to reach the contents that must be addressed to ensure the achievement of the desirable skills by an architect. Cooperative and interdependent actions dominate the analysis of a design carried out by a student without a prescribed theoretical content (declarative knowledge). However, it is supported by spontaneity depending on the phase of understanding regarding the array of implications taken in each design, that might change the participation structure. It works from what Vygotsky[15] called the zone of proximal development, in which the lecturer reacts depending on the degree of internalization of the content treated by the student. This is known as "procedural knowledge",

the kind of knowledge that it is displayed in common behaviour, but it is unconscious[16]. Specifically, in the architecture learning field, it is about visuospatial skills training that allow reading a floor plant and to build a three-dimensional image of the represented object in the mind[17]. A key skill to follow the problem-solving method in architectural studio design used at esGallaecia. It is the cycle of user research, ideation, prototyping, iteration, and the refinement process.

FINDINGS AND DISCUSSION

In the current architecture education system students have had to develop the visual thinking, so they can capture the link between speech and sketch that teachers do, in order to open cognitive windows. That is to say, to make them think in a different way to enhance their design, plenty of complexity that architecture involves. Students have to simultaneously focus their attention to an array of dimensions, needed to keep in mind. To design architecture, there is the need to employ information based on experience or on an opportunistic encounter, but also abstract information based on what they already know or have previously studied, in order to establish appropriate designs linked to a specific culture. Therefore, appropriate mental visualization of the space is a key-skill to handle successfully, complex spatial visualization tasks[18].

At present, Computer Aided Design has introduced profound changes in the traditional practice of Graphic Expression, the main tool for the development of visual thinking, which until just a few decades ago was relied exclusively on manual techniques. It is generally accepted that spatial skills can be developed through three-dimensional solid modelling, such as CAD applications[19]. But there are conflicting positions in this regard. Several studies[20] reveal that the development produced by solid modelling does not exceed that obtained by working with traditional two-dimensional views and projections.

On the other hand, it is necessary to highlight that the educational context underwent a restructuring with the effective implementation of the European Higher Education Bologna Agreement, in 2009. At esGallaecia there was not an adaptation from the old traditional educational system to the new Bologna system, but it meant a real reorganisation of knowledge learning, and a multidisciplinary approach, balanced with transversal appropriation of competences and skills[21]. Through this new approach, the student acquired freedom to configure his/her own academic career, through a thoughtful analysis in the acquisition of knowledge. However, it was observed that some difficulties were faced by students during their first year in Architecture. This is due to the fact that students do not always face the architectural degree with the necessary skills properly developed. This situation can be aggravated by the fact that currently, a student can enter Architecture studies without having completed Technical Drawing in High School.

As aforementioned, activity theory points out the context as paramount to address the complexities by studying relations between micro-level behaviours and macro-level phenomena. Students background also becomes a key-data to analyse, in order to understand how they develop their visual thinking.

Students who are more used to the daily use of technology will lean towards computer-aided design from the beginning, since it is a familiar media that does not involve them making great cognitive efforts. This is what Shelley Taylor[22] called cognitive miser, which is the preference for the use of strategies that optimize cognitive resources. That means, if the students grew up surrounded by the use of technology, applying technological tools during their architectural studies will create an easier learning process for them. In these cases, communication barriers of understanding can be raised,

between professors and students, in architectural design-studio, since the forced use of manual work can produce disaffection from the student side. This is illustrated by an ethnographic vignette - the case of the student who maintains his computer drawing system and then passes the computer drawing by hand, to be delivered as the teacher demands.

Also, to keep in mind that students know that when they enter in the professional world context, the possibility of accessing the first work experience will be highly influenced by the mastery of the software tools, which increases motivation for the students early learning regarding the use of technological over traditional representation systems. In this case, individual agency is affected by context.

CONCLUSION

The issue is not that the appearance of this technology prevents an adequate development of visual thinking, but it should be integrated in the new and actual educational context, following the creation of the European Higher Education Area (EEES). With its implementation, the hours devoted to the development of visuospatial capabilities were reduced, in general, as well as a less control time over the planned acquisition of knowledge, in relation to an increasing complexity of architecture.

This technological context and the educational system require a through adaptation by professors, who are not technicians implementing curricula, but professional decision makers solving problems [23]. Therefore, this is a new challenge to consider.

In modern information technology, new opportunities arise for arranging joint human-computer task performance: instead of using technology only for presentations, technology can become the tool for the development of the project. This could become a new challenge - to use technology in a cooperative way and through a problem-solving approach.

The main risk is not to be aware of this transformative relation between people, tools and artefacts that it has happened, so to be anchored in an old context forgetting to give qualitative skills in these tools that are part of architecture learning field. It is necessary to think about a trade-off between the potential benefits of the tools and the possible misuse of actually using them. Such cognitive support may improve the students' performance, as long as the lecturer accompanies them, to create procedural knowledge properly in the early use. Therefore, the right title of this paper should had been "new tools, new teaching".

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