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Resumo

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ARCHITECTURE AND COMPUTING IN THE DIGITAL ANTHROPOCENE. ARCHITECTURAL EDUCATION AND PROFESSIONAL OUTPUTS

ARQUITETURA E COMPUTAÇÃO NO ANTHROPOCENO DIGITAL. EDUCAÇÃO ARQUITETÓNICA E RESULTADOS PROFISSIONAIS

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Abstr**act:** The Anthropocene marks a change in geological epoch caused by the overload in the consumption of natural resources that humanity inflicts on the planet. This change imposes a vast number of changes in our habits, which are essential for our survival. Among others, it implies a radical change in the way we produce City and Architecture. This presentation reflects on the consequences of these changes in the way we teach Architecture, Urbanism and Planning. We start from the analysis of the problem, to the implications in the production of City and Architecture in the context of the digital era (the Anthropocene is contemporary to the digital) and we assess the upstream implications in the teaching of Architecture (understanding teaching as the main basis of transformation and social revolution necessary to face the challenges of the Anthropocene).

Key**words:** Architecture | Anthropocene | Natural resources | City | Teaching.

Resumo: O Antropoceno marca uma alteração de época geológica provocada pela sobrecarga no consumo de recursos naturais que a humanidade inflige ao planeta. Esta alteração impõe um vasto número de mudanças nos nossos hábitos indispensáveis à nossa sobrevivência. Entre outras, implica uma alteração radical no modo como produzimos Cidade e Arquitectura. Esta apresentação reflete sobre as consequências destas alterações no modo como ensinamos Arquitectura, Urbanismo e Planeamento. Partimos da análise do problema, para as implicações na produção de Cidade e Arquitectura no contexto da era digital (o Antropoceno é contemporâneo do digital) e aferimos quais as implicações a montante no ensino da Arquitectura (entendendo o ensino como a principal base de transformação e revolução social necessária para enfrentar os desafios do Antropoceno).

Palavras-chave: Arquitectura | Antropoceno | Recursos naturais | Cidade | Ensino.

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INTRODUCTION

The 20th Century marked a transition in geological epoch from the Holocene to the Anthropocene. This new epoch and denomination reflects the impacts inflicted by humanity on our planet, to the point of initiating an already observable shift in environmental conditions leading, if nothing is done to avoid it, to an almost certain extinction event (Meadows, Randers, and Meadows 2004). The impacts of mankind on earth, some say, can be traced back deep into the Holocene to the time of mammoth extinction, but its wider impact has been more evidently inflicted since the beginning of the industrial revolution and exponentially growing since the second half of the 20th century – at least impacts on the environment are now quite evident and traceable. Etymologically, the word Anthropocene (from the Greek word *Anthropos* meaning 'Man') demarks the impact of humans on the geological evolution to form a new epoch. To avoid such an apocalyptic aftermath, humans need to radically change their habits and environmental policies, and review the way they produce the built environment (Meadows, Randers, and Meadows 2004). Considering that the built environment constitutes one of the most impacting aggressions to our ecosystems, this paper reflects on the consequences of climate change and possible strategies to mitigate them, on the way we teach Architecture, Urbanism and Planning.

The paper starts from an analysis of the problem and its implications on the production of City and Architecture in the context of the digital Anthropocene. The digital condition of the present stage of technological development is seen as an opportunity for improving many habits rooted in our present societies, for rethinking the way we design and plan the built environment, and eventually, revert the present environmental crisis towards a more sustainable way of inhabiting our planet. Evidence that we can do it is already there (TED 2023), (Ritchie 2024), (Gates 2021) and it is worth trying. Then, we assess the upstream implications in the teaching of Architecture and Urbanism understanding teaching as the main vehicle of transformation and social revolution necessary to face the challenges posed by climate change. Under such reflection we assess our Architecture schools curricula and propose fundamental changes in their structure in opposition to the present conservative structure, particularly expressive in the context of Portugal¹. We present evidence that the conservative curricula in Portugal is present along the entire education process of a student, and assess the many pedagogical alternatives already well-known within the field of pedagogy which seem to face resistance from society and from educational institutions. We will also present evidence that Architecture curricula should be based on a much wider target than simply the education of practicing architects.

¹ The Portuguese context presents some peculiarities that makes it particularly interesting for the current discussion: on the one hand, there is much empirical evidence that the Portuguese architecture academy still stands on rather conservative premises and methods, but on the other hand Portuguese Architects and Portuguese Architecture in general has a high international reputation, and this reputation does not seem to have been reducing (or at least there is no evidence of that). So, this paradox makes the Portuguese case one of special interest.

THE CHALLENGES OF THE ANTHROPOCENE

The Anthropocene presents many urgent challenges to human kind, many of them that might be handled by architects, urban planners and designers in general, others by engineers, economists, politicians and other experts:

- Growth versus Reduction (Demographics and Economics)
- Climate Change
- Global Trade – High consumption – High Carbon Footprint
- Inequality – Uneven distribution
- To preserve Peace and Democracy in an overcrowded planet
- Digital inclusion and exclusion
- Robotics and Unemployment
- Artificial Intelligence and Automation
- Sustainability

The aim here is not to address each of these topics but to highlight the complexity embedded in them as well as the high degree of transdisciplinary required to properly address such complexity. Let's move forward to the implications in education.

THE CONSERVATIVE EDUCATION REALITY

Considering that high education academia should in principle be a place where new knowledge is being developed, one would expect that education curricula would tend to improve in terms of flexibility and innovative content, as well as decreasing in terms of conservatism at higher levels of education, while being a lot more conservative and fixed at basic education levels; however, it seems that reality is exactly the opposite – education curricula at the basic levels of education (primary school) is more flexible and modern (“Aprendizagens Essenciais - Ensino Básico | Direção-Geral Da Educação,” n.d.), more conservative at secondary school (“Ensino Secundário | Direção-Geral Da Educação,” n.d.), further more during higher education under-graduate level and even more at post-graduation level (e.g.: <https://www.fa.ulisboa.pt/index.php/pt/> (“Estudar,” n.d.)). At least this is the present Portuguese reality.

It is important to note here that the current curricular structure at basic school includes Information and Communication Technologies (ICT) and Art pedagogical contents at all levels of basic education (from 1st to 9th year – 6 to 15 years of age). The ICT programme for the first cycle (1st to 4th year) states the following objectives (https://www.dge.mec.pt/sites/default/files/Curriculo/Aprendizagens_Essenciais/1_ciclo/oc_1_tic_1.pdf - page 2):

- *“critical, reflected and responsible attitudes in the use of digital technologies, environments and services;*
- *online information research and analysis skills;*
- *ability to communicate appropriately, using digital means and resources;*
- *creativity, through the exploration of ideas and the development of computational thinking with a view to producing digital artefacts.”²*

² Translated from the Portuguese original.

Whether these contents are already put in practice in all its stated intentions or not is not the point; the important message here is that the intention is already written into official education policy.

In the case of high education, we will concentrate our attention on Architecture and Planning schools and Institutes, because Architecture and Planning education is the main object of this research, and in particular, the education for the production of a sustainable built environment where architects and designers in general may play an essential role. We also concentrate our attention on the Faculty of Architecture of the University of Lisbon (FAUL) not just because it is the oldest and largest architecture school in Portugal, but also because it contains design subjects from the hand scale to the city scale, being as such, at least potentially, the ideal place for flexibility and transdisciplinarity, hence containing the perfect latent conditions for innovation to emerge³.

Yet, Conservatism seems to be deeply embedded in education institutions and still rooted to old paradigms of rationalism and industrial management logic (RSA 2010), (TED 2007) imposing fixed curricula and fixed education visions based on the assumption that the main education contents are still the same; as if the essence of Architecture and Design would be unchangeable and the prerogative of just a few.

EDUCATION, ART, CREATIVITY AND HOW SOCIETAL PRECONCEPTIONS KILLS THEM

Ken Robinson (RSA 2010), (TED 2007) (PhD and Aronica 2016) argues that contemporary education systems are still ruled by rationalist industrial age ideals and Fordism organization methods where people were educated to fulfil particular well defined tasks for which very specific skills could be detailed in advance and therefore embedded into education programmes to prepare specialized skilled workers. Students were therefore seen as future pieces of a highly specialized production organization where creativity was not even acknowledged as necessary as long as the workers' skills to fulfil a specific task had been demonstrated and proven efficient. The role of education in such a context would be seen as a preliminary phase to prepare someone for a life enduring specialized job, a job seen also as one of the many gears of a large industrial manufacture organization. Robinson argues that in such an education model, school programmes were designed to educate people as very specialized task executors, parts of a large industrial production system. And therefore, he says, students were essentially educated '*out of creativity*' rather than '*into creativity*'. His main argument is that our present education system is still largely driven by these old fashioned ideas and therefore producing a education system maladjusted to the real needs of people, present societies and development challenges.

The importance of this statement becomes even more pertinent when reinforced by Richard Florida's ideas on creative society and in particular about the role of creativity in the development of new job opportunities, innovative ideas and

³ FAUL contains three main lines of education, Design, Architecture and Urbanism, with several branches of specialization, all of them under the methodological umbrella of design – a single method covering all specializations. As such, FAUL may be classified more generically as a school of design. Yet, we should highlight that ICT objectives such as the ones stated for basic education are not considered in FAUL's Architecture and Urbanism programmes. We will analyse this in detail further ahead.

economic developments (Florida 2014), (Florida 2005). Florida states that we are going through a new industrial revolution where old jobs are being replaced by automation and new jobs are emerging from a highly creative class with a much different profile from those found in the previous generations. In particular, he stresses the role of creativity in this process of change and even names this new class, the Creative Class, pointing out Creativity as its main feature. Florida highlights a set of features common to people in the creative class: (1) great entrepreneurship; (2) high creativity; (3) highly ambitious; (4) great job mobility; (5) capable of creating their own jobs; (6) highly skilled in new technologies and information technologies in particular; (7) tolerant and open minded; (8) with propensity to alternative lifestyles; and (9) many of them have (or have enrolled in) high degrees of academic education and/or research. As argued by (Gladwell 2006), successful people have been able to pursue freely their interests and build progressively their specific skills in very exclusive ways and very specific circumstances. The main message here is that a rigid education system based on established preconceptions might more certainly be constraining creativity, or even eliminating it, rather than promoting creativity. Based on the arguments of these authors (though many others could be mentioned to further support them⁴), we will start our criticism to the established education systems by assuming that (A) creativity is the central goal of education; (B) that creativity may only be fostered through freedom of choice; and therefore (C) that any education curricula that praises creativity can only be taken seriously if freedom of choice is fostered and not the opposite. The corollary of these should then state that the educational programmes that most foster creativity are the ones providing higher degrees of choice to their students. Conversely, a fixed educational curriculum can only frustrate creativity and restrict the appetite for it, in other words, 'educate students out of creativity'.

The argument of flexibility is further supported by Bermudez (2018) claiming it as an important additional feature to Rittel's (1971) visionary proposal to architecture education which already included the integration of information technology within curriculum. More importantly, Rittel proposed concepts like (1) teaching the necessary knowledge to obtain the required knowledge for solving a particular architectural problem; (2) to teach not only "*general rules but also rules to for the changing of rules*"; or (3) educating "*flexible professionals*" that are capable of adapting to varying tasks emerging from ill-defined problems or wicked problems (H. Rittel 1971) (H. W. Rittel 1977).

THE CONSERVATIVE ARCHITECTURE EDUCATION IN PORTUGAL. THE CASE OF THE LISBON SCHOOL OF ARCHITECTURE

FAUL is the oldest and largest Architecture school in Portugal and it has been the school out of which many renowned Portuguese architects have obtained their architecture degrees. These features make it a representative school of architecture within the Portuguese context and therefore we take it in this study as representative for the theme under analysis – Architecture Education in Portugal.

⁴ See also (Bermudez 2018), (Autor 2015), (Schon 1987), (Chomsky 2003) and (H. Rittel 1971)

FAUL offers an Integrated Master (BA + MA)⁵ programme in Architecture with three specialization areas: Architecture, Urbanism and Interior Architecture and Rehabilitation. A Bachelor degree in Design and several Master programmes in Design (Communication, Fashion, Product and Interaction Design) and one in Territorial Management and Urban Studies (in collaboration with other institutes)⁶. In terms of curricular flexibility, the Masters Design programmes are basically strict, but the Design Bachelor degree considers 12 ECTS credits in elective courses.

There are also three doctorate programmes covering Architecture, Urbanism and Design.

Two things become evident after a preliminary scroll down the courses contents and their current study plans: (1) there is a wide offer of Design contents; and (2) the Design courses integrate in their study plans a large amount of digital and technological contents (assuming that they are lectured with up to date knowledge), and that, should in principal cover a wide range of digital skills.

The first 3 years of the Integrated Master programme in Architecture (1st cycle) are common to all specialization areas and provide no space for elective courses – 120 ECTS credits of fixed academic curricula (Figure 1). Furthermore, the only evident digital disciplines are 'Digital Representation' and 'Geometric and Generative Modeling', 3rd and 4th semesters respectively, with 4 and 2 ECTS credits respectively. The reader should note that the names of the previous disciplines imply that three courses entitled 'Architectural Drawing' I, II and III, corresponding to a total of 18 ECTS credits, do not contain any digital representation of Architecture but refer to traditional drawing methods. A check through their specific programmes will confirm this implication. Additionally, the course 'Descriptive and Conceptual Geometry in Architecture', barely touches the digital while spending excessive attention on theoretical aspects of geometry and representation. This course corresponds also to 6 ECTS credits. In total, a fourth of the attention is put on digital contemporary methods rather than on centenary arguably outdated methods. In all cases BIM is seldom mentioned. Why not use all this workload to teach Architectural Representation from introduction to advanced digital skills, covering from CAD to BIM, from visual programming to tool customization? The available time would be enough to cover all the necessary advanced contents. GIS are also superficially addressed in the 'Geography' course⁷ and never applied in the practical courses, not even in 'Urbanism and Territorial Planning' (5th semester), which means that students end the first cycle forgetting how to use the basic tools for urban analysis and planning that are mandatory within current practice.

The second cycle (MA) provides only 12 credits in elective courses in a total of 120 credits (10% only, less than 5% in the whole Integrated Master Course). There are no explicit digital contents in the three specializations. Considering the scarcity of digital

⁵ Under the Portuguese law the higher education system is divide in three cycles, the 1st cycle corresponding to a Bachelor of Arts (BA), the 2nd cycle corresponding to a Master of Arts and the 3rd cycle to a doctorate degree (PhD). The images are taken from FAUL's website where the Portuguese nomenclature prevails.

⁶ <https://www.fa.ulisboa.pt/index.php/en/degrees>

⁷ The contents on GIS and spatial analysis largely depends on the professors' will to teach the tools and approach the programme topics by recurring to GIS analysis functions. Still, this course could be in potential the introductory course to GIS and spatial analysis methods.

resources provided in the 1st cycle, the academic curricula assumes that students will learn by themselves. BIM is ignored in the Architecture specialization, whilst GIS and spatial analysis are ignored in the Urbanism, City and Territory specialization. Students come out of the masters without the tools they will be required to use in architecture practice – no BIM management notions; no spatial planning notions.

The academic curricula are clearly very conservative, rigid in their determination (less than the usually considered 25% elective structure) and outdated in regard to advanced contemporary contents and especially in regard to digital contents revealing a pathological denial of the current digital real world. We will discuss this pathological conditions further ahead.

MiARO (1st Cycle)

1st Year 1st Semester		HCW ECTS	
Design Studio I	8	12	
Architectural Drawing I	4	6	
Descriptive and Conceptual Geometry in Architecture	4	6	
Applied Mathematics	2	3	
City, Architecture and Art Culture	2	3	
1st Year 2nd Semester			
Design Studio II	8	12	
Architectural Drawing II	4	6	
Building Materials	4	6	
History of Architecture I	2	3	
Statics	2	3	
2nd Year 1st Semester			
Design Studio III	8	12	
Digital Representation	4	6	
Geography	4	6	
Structural Design	4	6	
2nd Year 2nd Semester			
Design Studio IV	8	12	
Physics and New Materials for Architecture	4	6	
Architectural Drawing III	4	6	
Geometric and Generative Modeling	2	3	
History of Architecture II	2	3	
3rd Year 1st Semester			
Design Studio V	8	12	
Urbanism and Territorial Planning	6	9	
Building Technologies	4	6	
History of Architecture III	2	3	
3rd Year 2nd Semester			
Design Studio VI	8	12	
Interior Architecture and Building Rehabilitation	6	9	
Infrastructures, Systems and Regulations	4	6	
Theory of Architecture	2	3	

Figure 1- Integrated Master Programme, 1st Cycle (BA)

The doctorate programme presents an even worse panorama. Let us first frame what a doctorate degree in creative areas like Architecture, Urbanism and Design should be. (1) as any doctorate course, the output should be innovative; (2) should be creative; (3) they should be highly specialized (meaning also, highly technical) (4) should be meaningful and have societal impact; but more importantly, and considering that these areas of activity are in their nature cross-disciplinary, (5) they should potentially be more interesting and disruptive whenever they can bring more cross-disciplinary innovation. All these conditions imply that the more interesting and innovative the research is the less we are able to predict it. Essentially, it means that the more flexible the curriculum is, the better. In the case of FAUL's doctorate degree, the first year is structured as a strict academic curriculum, based on the assumption that the first year is a learning year. Two comments on this assumption. First, there is no way a researcher is going to fulfil all his/her knowledge requirements in a single year if true innovation is really going to be an output. Second, once true innovation is a fundamental requirement for a doctorate degree, the referred learning year must be highly specialized and advanced in all its possible cross-disciplinary conditions. The corollary of these comments is that any constraint on flexibility is nothing but a limitation to the real required knowledge development and possibly just a waste of time.

The present official doctorate programme includes, in its first year, two main mandatory courses, 'Research Methodology' and 'Research Seminar', the first introducing students to research methods, and the second providing a discussion space and support for students to develop their PhD research proposals. These courses correspond to a third of the 1st year's credits. Adding to these are three courses to be chosen from a short list from a specific knowledge field (Architecture / Urbanism / Design). These are, in practice, predefined and therefore could be interpreted as mandatory – this will be further discussed. The amount of credits corresponds to half of the total 1st year's credits. Finally, there is a 10 credit elective course. This would be in principle correct assuming that students choose a highly specialized course essential for their research. However, usually, students choose from a small set of generic predefined courses, hence not fulfilling the high specialization requirement they should. Nevertheless, this can be bypassed by the student as it essential his/her choice.

A few comments:

- This structure assumes that PhD students need an introductory year to deepen their knowledge on their research subjects and produce by the end of that year a valid PhD proposal to be submitted for approval. Such assumption may only be valid if a doctorate student begins the first year already in possession of basic knowledge on research methods and scientific writing, and that the required learning in the first year should be highly specialized and fully directed to the research topic s/he wants to pursue. Otherwise, the student will require at least an extra year to develop a qualified proficient proposal and three more to end the PhD.
- Two aspects derive from this situation: (1) if a student does not have basic knowledge on research methods and on writing research proposals, the additional courses will not bring the expected levels of specialization because they will be necessarily exploratory and generic, and consequently, the student will

have to consume at least one more year acquiring the necessary specialized knowledge; (2) if the student already has these basic research skills, and eventually have an idea of what s/he wants to do, then all generic elective courses will be a waste of time and as consequence will only be delaying the student, if not promoting frustration and deceit. Hence, in the latter situation, a student will only be interested in very specialized and specific courses, while in the former, the situation would be best handled by providing an introductory course on research methods, validation, scientific writing and knowledge disclosure⁸.

The conclusion can only be that any mandatory courses (in a first year) have simply no sense in a PhD programme because they constrain innovation and distract the most valid researchers from their work. The academic programme provided by FAUL for PhD level is therefore not flexible enough and hence inappropriate.

As an additional sustaining argument, design problems and especially architectural design problems have always been classified as the hardest to compute and defined as *wicked problems* (H. W. Rittel 1977) (H. Rittel 1971) due to (1) their complexity (functional, technical and social), (2) transdisciplinary extent, (3) encompassing conflicting technical requirements and regulatory constraints, (4) having many valid solutions, and (5) having to respond to idiosyncratic aesthetical values (Simon 1996), (Cross 2011), (Lawson 2006). Such complexity of transdisciplinary viewpoints cannot be tackled by single path strategies and requires a clear necessity of open customisable transdisciplinarity. Furthermore, the access to highly advanced contents in several knowledge domains is also a necessity, because, an innovative researcher should be in the front line and many times bringing into the design fields subjects traditionally considered unexpected like biology, chemistry and artificial intelligence (Florida 2014), (Braungart and McDonough 2009). Designers⁹ in academia who do not accept this have an obvious misunderstanding of their job. Finally, the challenges of the Anthropocene definitely require holistic transdisciplinary approaches; if architects, urbanists and designers are to have a role in mitigating our environmental problems, the first step must be an open mind to transdisciplinary innovation, to technology, and to unforeseen ideas.

THE ROLE OF ARCHITECTURE AS A SPRINGBOARD FOR INNOVATION

As previously exposed, Florida (2014) points out a handful of common characteristics of people involved in creative jobs, of those that compose today's most representative professional class, the creative class. Among them, many overlap the main characteristics of successful architects: (1) skilled in creative methods, (2) especially in design methods, (3) trained in cross-disciplinary holistic synthesis, (4) seeking for innovative solutions; and, Florida so assumes, (5) highly proficient in digital technologies. Many of the biggest architecture offices nowadays seek people with these characteristics (e.g: UNStudio, Zaha Hadid, BIG among others). Programming skills and use of AI tools is now very common to appear in job position requirements in these larger offices.

⁸ ... and this course is already available at FAUL: <https://www.fa.ulisboa.pt/index.php/pt/cursos/pos-graduacoes/introducao-a-investigacao-em-arquitetura-urbanismo-e-design>

⁹ Architects, Urbanists and creative designers in general.

The main argument emerging from Florida's is that architects encompassing all these skills are the best creative candidates for developing innovative ideas, whether they might be architectural innovations or simply innovations of some kind. In fact, Florida argues that these are the people inventing the future jobs, jobs that we cannot imagine now but will surely appear in the future. In this paper, we want to sustain this argument and add that all areas of design contain such potential. If we accept this, schools like FAUL should be in a very privileged position because it provides design education from hand to city scale. Possibly also a privileged position to develop innovative solutions for answering creatively the challenges of the Anthropocene.

THE CASE OF THE LISBON SCHOOL OF ARCHITECTURE – DESIGN AT ALL SCALES – FROM THE HAND TO THE CITY

As we have seen above, FAUL offers education on many different fields of design, namely, Communication, Graphic, Industrial and Fashion Design, Architecture and Urbanism, providing courses that are specific to these areas, though still missing many contents on contemporary digital methods and advanced digital methods. Admitting that such digital programmes could easily be included in the academic curricula, such a school of design would potentially be a natural cauldron for innovation.

In order to unleash such potential for innovation, FAUL would only have to get rid of its predefined reductionist and deterministic structure and replace it with an entirely customizable structure. Such a suggestion is generally criticized with arguments stating: (1) that there will not be a rigorous way to tell which diploma should a specific student get when his/her education is composed of courses from many different areas; (2) that such type of approach would drive the administration unmanageable.

The latter criticism is a management problem and therefore should be in principle rather easy to solve with contemporary digital management tools. As such, let us concentrate on the first criticism, for this is the scientific/pedagogical one.

WHAT TO DO? SOME IDEAS

Let's start with a disrupting argument: maybe the best would be to have a diploma with a minimum number of ECTS credits without specifying any particular area of design (whatever the scale or the object of design). This could be left entirely to the student's decision and the diploma should contain an annex describing the specific courses and results obtained by the student and stating the total number of credits obtained¹⁰. In such a case, we would only have to specify that a bachelor degree would require a minimum of, say, 180 ECTS credits (just to keep the present standard) and an additional minimum of 120 ECTS credits for a master degree. Post graduations and doctoral degrees will be addressed after these.

¹⁰ There is an assumption in academic administration that a degree should correspond to an exact number of credits eventually driving students to frustration for not being able to choose a specific course because it allegedly sums up more than the degree's total number of credits. If not having the necessary credits is a justifiable argument, having too many cannot be rationally understood as a justifiable argument for creating choice limitations to students. However, this footnote would not be here if such situations had never occurred.

Still, accepting that specific diplomas could be issued, such a scenario could also be easily managed. To simplify the argument, let's assume that all degrees keep the same existing structure (accepting that the digital contents have been inserted in the Architecture and Urbanism curricula – the Design degrees may be considered as they are). In an academic programme all courses require scientific approval by a scientific council. If in such approval procedure the course's credits are attributed to a specific or several knowledge areas – some courses might be eligible for more than one knowledge area – a student would only have to sum up a minimum number of credits in a knowledge area to obtain the degree in that area. For example, let's say that to obtain a bachelor in Architecture a student is required to obtain 50% of credits (90 ECTS credits) in courses recognized as belonging to the Architecture knowledge area, the student would be free to choose the courses summing those 90 credits from all provided courses classified as belonging to the Architecture area and freely choose 90 credits from whatever is available at the school customizing the course to her/his expectations. In fact, we could even argue that having a small number of credits from courses provided by other institutes would cross pollinate creatively the future outcomes (e.g.: contents from biology, landscape Architecture and chemistry are very much in tune with the present innovation trends) and eventually foster innovation. This could also foster transdisciplinary protocols and consortium building. Assuming as an example that a particular student would sum up 90 credits from Architecture, 60 credits from Urbanism, 20 credits from Industrial Design and 10 credits from other courses (possibly from different institutes), and admitting that this student was willing to attend some extra 30 credits in Urbanism courses, this student would be in position of obtaining two bachelor degrees, one in Architecture and another in Urbanism¹¹.

What the examples in the previous paragraph mean, is that there are ways of keeping some degree of control over the conditions upon which a specific diploma may be issued, but the underlying message is that less the control equates higher flexibility, and therefore, the better the academic curricula because higher flexibility should promote higher innovation potential and certainly a great diversity of education outputs to pollinate the country with novelty. Above all, such a structure would be a lot more in tune with our present society and the challenges of the Anthropocene, and particularly responsive to the main characteristic of the present century: continuous change and continuous upgrade. Additionally, such flexible structure would allow the introduction of post-graduation certificates designed for people willing to update their knowledge in order to keep pace with transformation and evolution – a true *education-through-life* programme.

¹¹ The previous sentence assumes that in a school of Architecture, Urbanism and Design, there are three departments with a corresponding name, each representing a corresponding knowledge area. However, the present structure at FAUL is more complex including several additional departments, namely, (1) Geometry, Drawing and Computation, (2) History and Theory of Architecture, Urbanism and Design, (3) Technologies for Architecture, Urbanism and Design, and (4) Social Sciences and Sciences of the Territory. In total there are 7 departments. This fact does not invalidate the argument of attributing credits to knowledge areas; it only makes it a bit more complicated. This means that the attribution of a diploma should be based on how many credits should be requested per knowledge area to issue a specific diploma as long as a minimum of 30% to 40% of the credits stay free for the students to choose. Also, this does not mean that specific courses have to be attended; it means that the choice is simply more restricted to a certain number of courses but still wide enough to provide individual customization.

A common opposition to this type of proposal is an argument based on the European norm for Architecture Education which sets a template structure defining the percentage of courses from specific areas of knowledge (corresponding to the 4 additional knowledge areas that presently exist at FAUL – see footnote 9) together with architectural design. The opposition is based on the fact that this norm does not leave much space for flexibility. This norm stands as a common European agreement over the conditions upon which architects may have an education that is comprehensive enough for the requirements of the practice; in other words, what architects need to know to be able to act as practicing architects. There are two main misconceptions in such an interpretation. The first is the assumption that the role of Architecture Education serves the exclusive purpose of educating practicing architects. Statistics at European level prove such assertions to be wrong – large percentage of architects do not practice. The second misconception is the assumption that all students need to be educated in the same way and that a diploma assumes the existence of an equal structure. This assumption contradicts and thwarts the argument of flexibility and customization, and a diploma need not be based on an equal structure, but, as argued, on a set of minimum requirements. Once a diploma contains the list of courses done by a student, and students may even be able to add extra credits to their diplomas, the problem becomes irrelevant. Furthermore, a specific student might not be interested in Architecture practice, but possibly in something more important, relevant, local, urgent, profitable and specific that we cannot imagine in advance. In any case, this student would always have the choice to add credits to his/her education by doing additional credits with the necessary courses to obtain the European requirements. Open structure for an open mind should be the motto. But before, we need to open minds to take such step. This is also in line with the very multilateral foundations of the E.U. and international organizations, as well as the inter-disciplinary and international collaboration deemed both urgent and necessary to tackle the climate crisis and other challenges of the Anthropocene. The future requires new ideas, high degrees of innovation at many levels where architects can make a difference (including very specific areas such as architectural engineering, digital fabrication, performance simulation and analysis, data analysis, material science, new construction systems, buildings circularity and sustainability, bio-based materials and so on). Innovation may come in formats we cannot even imagine. Only freedom will be able to unleash it and bloom.

THE TYRANNY OF THE DESIGN STUDIO

Design studios have always been at the centre of an Architecture programme. There are many reasons to support it as the central part of the programme, not because of its massive number of credits, but because everyone acknowledges its importance in teaching design methods and preparing an architect for practice. Both Rittel (1971) and Schön (1987)(1984) highlight the role of learning by doing. However, only a few students end up entering the Architecture practice. Many choose other paths, from territorial management to the construction industry, as well as education or consultancy. Another large percentage, find even less related jobs, or even not related at all. Some may create new jobs. The important argument to add to this paper, is that it might be unwise to

impose the design studio as mandatory. We should leave such decision to students – they will acknowledge appropriately the degree of its importance. Once they know the European Directive the chances are most of them will try to attend studios. Also, once we accept that students may choose to add credits above the minimum required that may already provide high degrees of customization to their curricula. But, if someone is not interested at all in the practice, imposing a fixed structure may only lead to frustration, possibly suffocating a latent innovative mind (perhaps a highly inventive mind) driving the student *out of creativity*. Once again, more freedom satisfies more people and fosters higher degrees of successful creativity.

This paper can only end with a set of obvious questions: why is it that Architecture schools in Portugal impose such straitjackets to Architecture students? Doesn't it defeat the purpose of teaching people to be creative? Why is it that FAUL's Architecture curricula is still analogue at the end of the first quarter of the XXI century? Chomsky would argue that such an education structure is under aristocratic thought. It is the time to change it into a democratic structure. An evidence of this lack of democratic structure becomes obvious when we think that evaluation in any of the referred courses is always a prerogative of professors and self-evaluation is not even discussed as a possible way of evaluating work. Flexibility is indeed missing, both in thought and structure.

DISCLAIMER

Despite the criticism put forward in this paper the author would like to underline that as conservative as the education at FAUL might be, the best students coming out of the Architecture Master level can usually find work successfully in Europe and sometimes even start a successful private practice. Furthermore, almost every year final students from FAUL are awarded Archiprix prizes, a fact that seems to validate the argument that at least something is possibly being done correctly, at least if professional competence is being evaluated.

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