



## FICHA DE UNIDADE CURRICULAR

### Unidade Curricular

202299206 - Introdução às gramáticas da forma

### Tipo

Optativa

Ano lectivo	Curso	Ciclo de estudos	Créditos
2022/23	MI Interiores MI Arquitetura - Esp.Arq MI Arquitetura - Esp.Urb	2º	3.00 ECTS
Idiomas	Periodicidade	Pré requisitos	Ano Curricular / Semestre
Português ,Inglês	semestral		

### Área Disciplinar

Desenho, Geometria e Computação

### Horas de contacto (semanais)

Teóricas	Práticas	Teórico práticas	Laboratoriais	Seminários	Tutoriais	Outras	Total
0.00	0.00	3.00	0.00	0.00	0.00	0.00	3.00

### Total Horas da UC (Semestrais)

Total Horas de Contacto  
42.00

Horas totais de Trabalho  
84.00

### Docente responsável (nome / carga lectiva semanal)

Luís António dos Santos Romão

### Outros Docentes (nome / carga lectiva semanal)

Luís António dos Santos Romão 3.00 horas

### Objetivos de aprendizagem (conhecimentos, aptidões e competências a desenvolver pelos estudantes)

Esta disciplina tem como objetivos concretos:

(1) Introduzir um processo de apoio à conceção usando um processo computacional, ou generativo, nas suas componentes teóricas e práticas;

- (2) Introduzir o paradigma de um processo computacional que se caracteriza por ser o primeiro a introduzir uma dimensão visual e que atualmente continua a ser o único a fazê-lo;
- (3) Fornecer meios estruturados de análise e de síntese quer para compreender linguagens de projeto existentes quer explorar novas linguagens.

### **Conteúdos Programáticos / Programa**

- (1) Introdução às gramáticas da forma: teoria e aplicações em arquitetura, urbanismo e design;
- (2) As gramáticas de forma no ensino;
- (3) Forma, forma analítica, computação da forma, transformações no espaço Euclidiano, álgebras;
- (4) Relação espacial, regra, rótulos, derivação, recursão, parametrização;
- (5) Gramáticas de cor e de pesos;
- (6) Gramáticas compostas;
- (7) Gramáticas descritivas;
- (8) Aplicações em arquitetura, urbanismo e design;
- (9) Críticas à teoria, analogias com as gramáticas de Chomsky e à máquina de Turing;
- (10) Transformações estilísticas;
- (11) Interpretadores de gramáticas 2D;
- (11) Interpretadores de gramáticas 3D.

As aulas serão suportadas por leituras de artigos que desenvolvem particularmente cada tema e pela realização de pequenos trabalhos práticos.

### **Demonstração da coerência dos conteúdos programáticos com os objectivos de aprendizagem da unidade curricular**

Os conteúdos listados constituem a base para o entendimento do conceito que esta disciplina procura ensinar. São deixados na bibliografia outros artigos que podem ser de interesse para uma investigação mais específica.

### **Metodologias de ensino (avaliação incluída)**

- 1. Leituras (50% da nota final): O primeiro trabalho é realização de uma coletânea de mini exercícios (10) realizados numa base semanal.
- 2. Trabalho final (50% da nota final): a escolher pelo aluno com o acordo do docente, entre as duas alternativas seguintes:
  - 2.1 Ensaio teórico sobre um tema particular do universo das gramáticas da forma;
  - 2.2. Esboço de uma gramática de uma obra existente ou construção de uma nova gramática a partir do zero.

### **Demonstração da coerência das metodologias de ensino com os objectivos de aprendizagem da unidade curricular**

As gramáticas da forma têm uma componente teórica muito alargada, no entanto esta só pode ser compreendida se o formalismo da mesma for testado porque assim ajuda a cimentar o conhecimento transmitido.

### **Bibliografia Principal**

Stiny, G., (2006), *Shape: Talking about seeing and doing*. Cambridge, Mass.: MIT Press

### **Bibliografia Complementar**

Chau, H. H. (2004) Evaluation of a 3D Shape Grammar Implementation. *Design Computation and Cognition '04*, JS Gero (Ed.), pp.357-376. Chomsky N. (1957) *Syntactic Structures*. The Hague: Mouton. Reprint. Berlin and New York (1985). Duarte, J. P. (2005) A Discursive Grammar for Customizing Mass Housing: the case of Siza's houses at Malagueira. *Automation in Construction*, 14(2), pp.265-275, Elsevier Science. Fleisher, A. (1992) Grammatical architecture?. *Environment and Planning B: Planning and Design*, 19, pp.221-226. Koning, H., and Eisenberg, J. (1981) The language of the prairie: Frank Lloyd Wright's prairie houses. *Environment and Planning B: Planning and Design*, 8, pp.295-323. Li, Andrew I-kang (2001) Teaching style grammatically, with an example from traditional Chinese architecture. In *The proceedings of Mathematics & design 2001: the third international conference (3-5 July 2001, Geelong, Australia)*, pp.270-277. Knight, T. W. (1989) *Shape Grammars in Education and Practice: History and Prospects*. Internet Paper. <http://www.mit.edu/~tknight/IJDC/> Knight, T. W. (1989) Color grammars: designing with lines and colors. *Environment and Planning B: Planning and Design*, 16, pp.417-449. Knight, T. W. (1989) Transformations of De Stijl art: the paintings of Georges Vantongerloo and Fritz Glarner. *Environment and Planning B: Planning and Design*, 16, pp.51-98. Knight, T. W. (1993) Color Grammars: the Representation of Form and Color in Design. *Leonardo*, 26, pp.117-124. Stiny G., and Gips J. (1972) Shape Grammars and the Generative Specification of Painting and Sculpture. C V Freiman (ed) *Information Processing 71* (Amsterdam: North-Holland) 1460-1465. Republished in Petrocelli O R (ed) *1972 The Best Computer Papers of 1971: Auerbach, Philadelphia* pp.125-135. Stiny, G. (1976) Two exercises in formal composition. *Environment and Planning B: Planning and Design*, 3(2), pp.187-210. Stiny, G. and Mitchell, W. J. (1978) The Palladian grammar. *Environment and Planning B: Planning and Design*, 5, pp.5-18. Stiny, G. and Mitchell, W. J. (1980) The grammar of paradise: on the generation of Mughul gardens, *Environment and Planning B: Planning and Design*, 7, pp.209-226. Stiny, G. (1980) Kindergarten grammars: designing with Froebel's building gifts. *Environment and Planning B: Planning and Design*, 3, pp.461. Stiny, G. (1980) Introduction to shape and shape grammars. *Environment and Planning B: Planning and Design*, 7(3), pp.343-351. Stiny, G. (1990) What is a design?. *Environment and Planning B: Planning and Design*, 17, pp.97-103. Stiny, G. (1992) Weights. *Environment and Planning B: Planning and Design*, 19, pp.413-430. Turing, A. (1936) On Computable Numbers, With an Application to the Entscheidungsproblem, *Proceedings of the London Mathematical Society*, 42 (2)



## CURRICULAR UNIT FORM

### Curricular Unit Name

202299206 - Introduction to Shape Grammars

### Type

Elective

#### Academic year

2022/23

#### Degree

IM Interiors

#### Cycle of studies

2

#### Unit credits

3.00 ECTS

#### Lecture language

Portuguese ,English

#### Periodicity

semester

#### Prerequisites

#### Year of study/ Semester

### Scientific area

Drawing, Geometry and Computation

### Contact hours (weekly)

Tehoretical	Practical	Theoretical-practicals	Laboratory	Seminars	Tutorial	Other	Total
0.00	0.00	3.00	0.00	0.00	0.00	0.00	3.00

### Total CU hours (semester)

#### Total Contact Hours

42.00

#### Total workload

84.00

### Responsible teacher (name /weekly teaching load)

Luís António dos Santos Romão

### Other teaching staff (name /weekly teaching load)

Luís António dos Santos Romão 3.00 horas

### Learning objectives (knowledge, skills and competences to be developed by students)

This course aims to: (1) Introduce a process to support design using a generative or computational process in their theoretical and practical components;  
(2) Introduce the paradigm of a computational process that takes into account visual aspects, and which currently continues to be the only one to do so comprehensively;

(3) Provide a structured means to analyse and synthesize shape both for understanding existing design languages and for exploring new ones.

## **Syllabus**

- (1) Introduction to shape grammars: theory and applications in architecture, urbanism and design;
- (2) Shape grammars in education;
- (3) Form, shape analysis, shape computation, transformations in Euclidean space, algebras;
- (4) Spatial relations, rules, labels, derivation, recursion, parameterization;
- (5) Colour and weight grammars;
- (6) Compound grammars;
- (7) Descriptive grammars;
- (8) Applications in architecture, urbanism and design;
- (9) Critics of the theory, analogies with Chomsky grammars and Turing machines;
- (10) Stylistic transformations;
- (11) 2D grammars interpreters;
- (11) 3D grammars interpreters.

Classes will be supported by a series of readings and the development of small practical assignments on selected themes.

## **Demonstration of the syllabus coherence with the curricular unit's learning objectives**

The contents listed the basis for understanding the concept that this discipline seeks to teach. Other articles that may be of interest for a more specific investigation are left on the bibliography.

## **Teaching methodologies (including evaluation)**

1. Readings (50% of final grade): The first work is a collection of mini assignments (10) that will be done in a weekly basis.
2. Final work (50% of final grade): to choose by the student with the agreement of the teacher, between the following two alternatives:
  - 2.1. Theoretical essay on a particular theme from the universe of shape grammars;
  - 2.2. Sketch of a grammar of an existent work, or a brand new grammar starting from the scratch.

## **Demonstration of the coherence between the Teaching methodologies and the learning outcomes**

The shape grammars concept have a very broad theoretical component, this can only be understood if the formalism of the it could be tested because this helps to cement the transmitted knowledge.

## Main Bibliography

Stiny, G., (2006), Shape: Talking about seeing and doing. Cambridge, Mass.: MIT Press

## Additional Bibliography

Chau, H. H. (2004) Evaluation of a 3D Shape Grammar Implementation. Design Computation and Cognition '04, JS Gero (Ed.), pp.357-376. Chomsky N. (1957) Syntactic Structures. The Hague: Mouton. Reprint. Berlin and New York (1985). Duarte, J. P. (2005) A Discursive Grammar for Customizing Mass Housing: the case of Siza's houses at Malagueira. Automation in Construction, 14(2), pp.265-275, Elsevier Science. Fleisher, A. (1992) Grammatical architecture?. Environment and Planning B: Planning and Design, 19, pp.221-226. Koning, H., and Eisenberg, J. (1981) The language of the prairie: Frank Lloyd Wright's prairie houses. Environment and Planning B: Planning and Design, 8, pp.295-323. Li, Andrew I-kang (2001) Teaching style grammatically, with an example from traditional Chinese architecture. In The proceedings of Mathematics & design 2001: the third international conference (3-5 July 2001, Geelong, Australia), pp.270-277. Knight, T. W. (1989) Shape Grammars in Education and Practice: History and Prospects. Internet Paper. <http://www.mit.edu/~tknight/IJDC/> Knight, T. W. (1989) Color grammars: designing with lines and colors. Environment and Planning B: Planning and Design, 16, pp.417-449. Knight, T. W. (1989) Transformations of De Stijl art: the paintings of Georges Vantongerloo and Fritz Glarner. Environment and Planning B: Planning and Design, 16, pp.51-98. Knight, T. W. (1993) Color Grammars: the Representation of Form and Color in Design. Leonardo, 26, pp.117-124. Stiny G., and Gips J. (1972) Shape Grammars and the Generative Specification of Painting and Sculpture. C V Freiman (ed) Information Processing 71 (Amsterdam: North-Holland) 1460-1465. Republished in Petrocelli O R (ed) 1972 The Best Computer Papers of 1971: Auerbach, Philadelphia pp.125-135. Stiny, G. (1976) Two exercises in formal composition. Environment and Planning B: Planning and Design, 3(2), pp.187-210. Stiny, G. and Mitchell, W. J. (1978) The Palladian grammar. Environment and Planning B: Planning and Design, 5, pp.5-18. Stiny, G. and Mitchell, W. J. (1980) The grammar of paradise: on the generation of Mughul gardens, Environment and Planning B: Planning and Design, 7, pp.209-226. Stiny, G. (1980) Kindergarten grammars: designing with Froebel's building gifts. Environment and Planning B: Planning and Design, 3, pp.461. Stiny, G. (1980) Introduction to shape and shape grammars. Environment and Planning B: Planning and Design, 7(3), pp.343-351. Stiny, G. (1990) What is a design?. Environment and Planning B: Planning and Design, 17, pp.97-103. Stiny, G. (1992) Weights. Environment and Planning B: Planning and Design, 19, pp.413-430. Turing, A. (1936) On Computable Numbers, With an Application to the Entscheidungsproblem, Proceedings of the London Mathematical Society, 42 (2)