



## FICHA DE UNIDADE CURRICULAR

### Unidade Curricular

201999202 - INTRODUÇÃO ÀS GRAMÁTICAS DA FORMA

### Tipo

Optativa

Ano lectivo	Curso	Ciclo de estudos	Créditos
2019/20	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 uma coletânea de mini textos (1/2 a 1 página) com o comentário crítico a cada uma dos temas/textos que vão sendo lidos semanalmente.
2. Trabalho final (50% da nota final): a escolher pelo aluno com o acordo do docente, entre as três alternativas seguintes:
  - 2.1 Ensaio teórico sobre um tema particular do universo das gramáticas da forma;
  - 2.2. Esboço de uma gramática analítica ou sintética.

### **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

201999202 - Introduction to Shape Grammars

### Type

Optativa

#### Academic year

2019/20

#### Degree

MI Interiores  
MI Arquitetura - Esp.Arq  
MI Arquitetura - Esp.Urb

#### Cycle of studies

2º

#### Year of study/ Semester

3.00 ECTS

#### Lecture language

Português ,Inglês

#### Periodicity

semestral

#### Prerequisites

#### Unit credits

### Scientific area

Desenho, Geometria e Computação

### 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 (semestrial)

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 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 analyze 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) Color 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 exercises 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 texts (1/2 to 1 page) with a critical commentary on each of the texts read weekly.
2. Final work (50% of final grade): to choose by the student with the agreement of the teacher, between the following three alternatives:
  - 2.1 Theoretical essay on a particular theme from the universe of shape grammars;
  - 2.2. Sketch of an analytic or synthetic grammar.

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

The shape grammars have a very broad theoretical component, however 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.
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- 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.
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- Stiny, G. (1980) Kindergarten grammars: designing with Froebel's building gifts. *Environment and Planning B: Planning and Design*, 3, pp.461.
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- Turing, A. (1936) On Computable Numbers, With an Application to the Entscheidungsproblem, *Proceedings of the London Mathematical Society*, 42 (2).