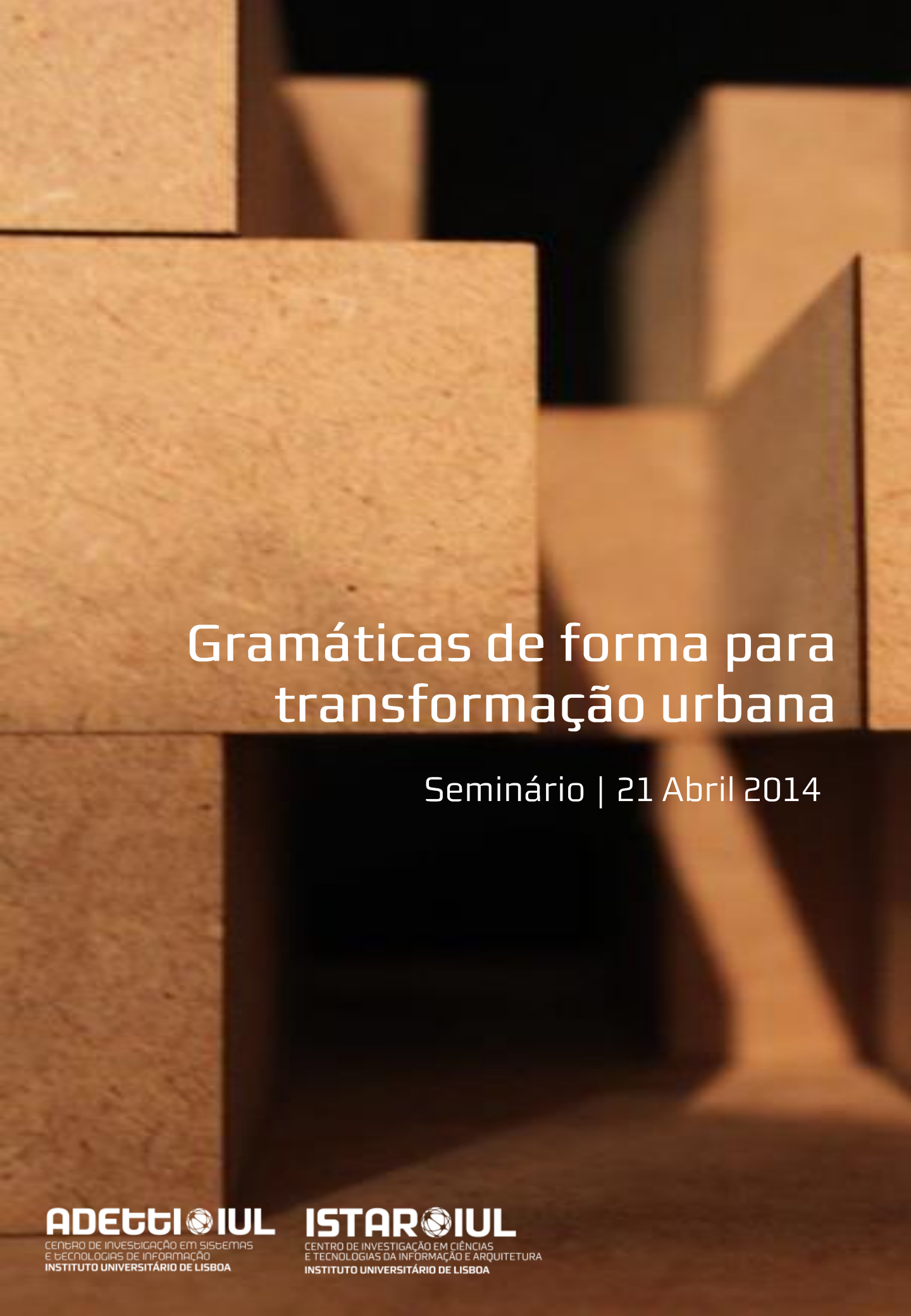


Gramáticas de forma para transformação urbana

Seminário | 21 Abril 2014

ADETTI IUL
CENTRO DE INVESTIGAÇÃO EM SISTEMAS E TECNOLOGIAS DE INFORMAÇÃO
INSTITUTO UNIVERSITÁRIO DE LISBOA

ISTAR IUL
CENTRO DE INVESTIGAÇÃO EM CIÊNCIAS E TECNOLOGIAS DA INFORMAÇÃO E ARQUITETURA
INSTITUTO UNIVERSITÁRIO DE LISBOA

10h00 | Gramáticas de Forma e Gramáticas de Transformação
Sara Eloy

10h20 | A Ferramenta shell para Gramáticas de Forma GSG
Joaquim Reis

10h40 | A Interface para o Sistema GSG
Paulo Canilho

11h00 | Sistemas de Informação Geográfica e City Engine
Rui Ricardo e Rúben Reis

11h20 | Desenvolvimento de Apps para arquitetura
Pedro Faria Lopes

11h40 | Debate

Organização: Miguel Sales Dias, Sara Eloy, Joaquim Reis
Autoria da imagem de capa: José Ferrão
Edição: Ana Moural

Gramáticas de Forma e Gramáticas de Transformação

Sara Eloy

Gramáticas de forma e gramáticas de transformação

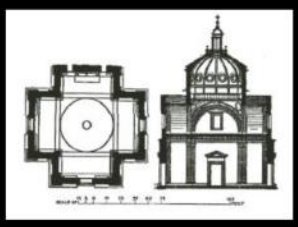
Sara Eloy

ADETTI IUL

ISTAR IUL

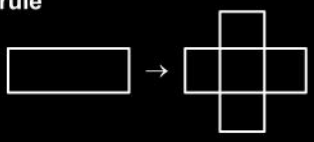
Shape grammar uses rules that applied step-by-step to existing shapes will generate a language of designs or describe an existing one

$A \rightarrow B$

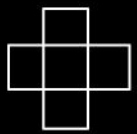


Vocabulary (shapes)

Shape rule



Spatial relations



New Design = [Design - t (A)] + t (B)]

Spatial transformations
Boolean operations

Procedure for defining the entasis of a column (Palladio)

The columns in each order ought to be form'd in ſuch a manner, that the diameter of the upper part of the column may be ſmaller than at the bottom, with a kind of a ſwelling n the middle.

As to the manner of making the ſwelling in the middle, we have no more to ſhew from VITRUVIUS but his bare promiſe; which is the reaſon that moſt writers differ from one another upon that ſubject.

The method I uſe in making the profile of the ſwellings is this; I divide the fuſt of the column into three parts, and leave the lower part perpendicular; to the ſide of the extremity of which I apply the edge of a thin rule, of the ſame length, or a little longer than the column, and bend that part which reaches from the third part upwards, until the end touches the point of the diminution of the upper part of the column under the *collarino*. I then mark as the curve directs, which gives the column a kind of ſwelling in the middle, and makes it project very gracefully.

And although I never could imagine a more expeditious and ſucceſsful method than this, I am neverthele ſs confirmed in my opinion, ſince Signor PIETRO CATANEO was ſo well pleaſed when I told him of it, that he gave it a place in his Treatiſe of Architecture, with which he has not a little illuſtrated this profeſſion.

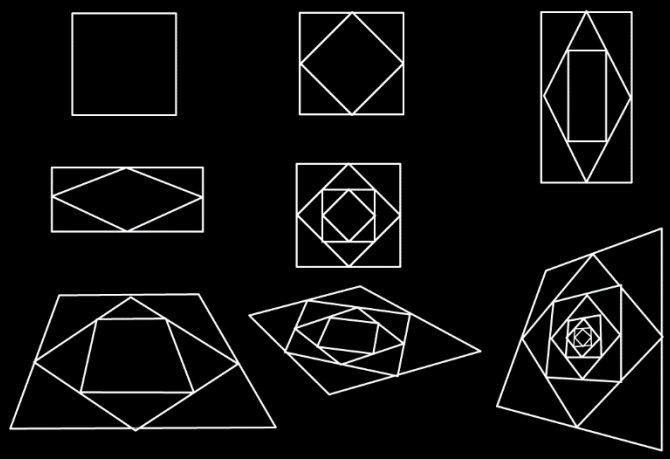
A B, *the third part of the column, which is left directly perpendicular.*
B C, *the two thirds that are diminiſhed.*
C, *the point of diminution under the* collarino.

Shape rules

Derivation

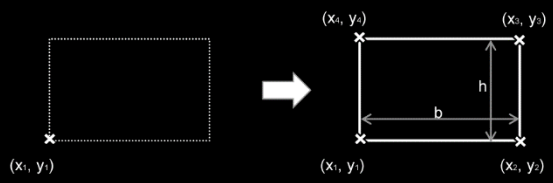
EMERGENCE
seeing without memory
deborah benrós

Corpus of solutions



SHAPE GRAMMARS CREATES / DEFINES A LANGUAGE OF DESIGN

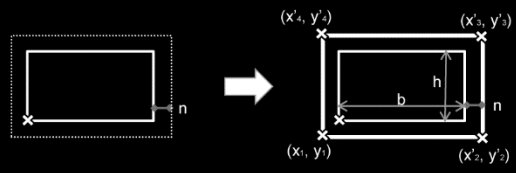
Parametric rules



$X \rightarrow X + b\ (X)$

$(x_1, y_1) \rightarrow (x_1, y_1) + (x_2, y_2) + (x_3, y_3) + (x_4, y_4)$

$(x_1, y_1) \rightarrow (x_1, y_1) + (x_1+b, y_1) + (x_1+b, y_1+h) + (x_1, y_1+h)$



$X \rightarrow b\ (X) + n\ .\ b\ (X)$

$(x_1, y_1) \rightarrow (x_1, y_1) + (x'_1, y'_1) + (x'_2, y'_2) + (x'_3, y'_3) + (x'_4, y'_4)$

$(x_1, y_1) \rightarrow (x_1, y_1) + (x_1+b, y_1) + (x_1+b, y_1+h) + (x_1, y_1+h)$

Analytical grammars

make it possible to understand existing languages

Original grammars

enable new design languages to be created

Analytical grammars

make it possible to understand existing languages

± ice ray, chinese lattice design, George Stiny

± palladian villas grammar, George Stiny and William Mitchell

+ frank lloyd wright's prairie houses grammar, Koning and Eisenberg

+ chinese architecture grammar, Andrew Li

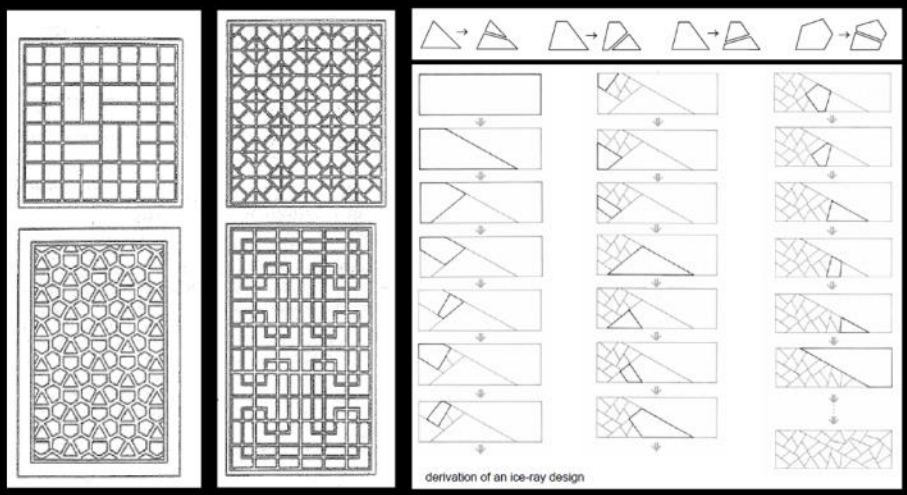
± gramática da malagueira, José Pinto Duarte

+ digital thonet, Mário Barros

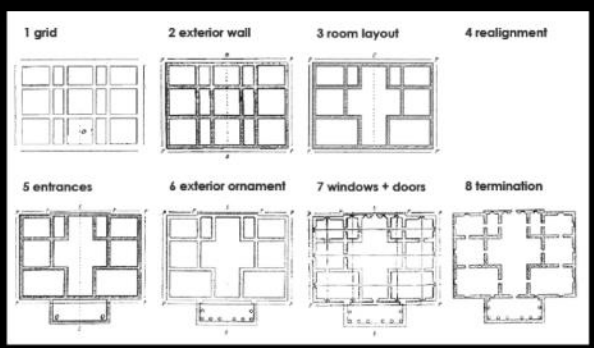
Original grammars

enable new design languages to be created

ice rays, chinese lattice designs_ George Stiny

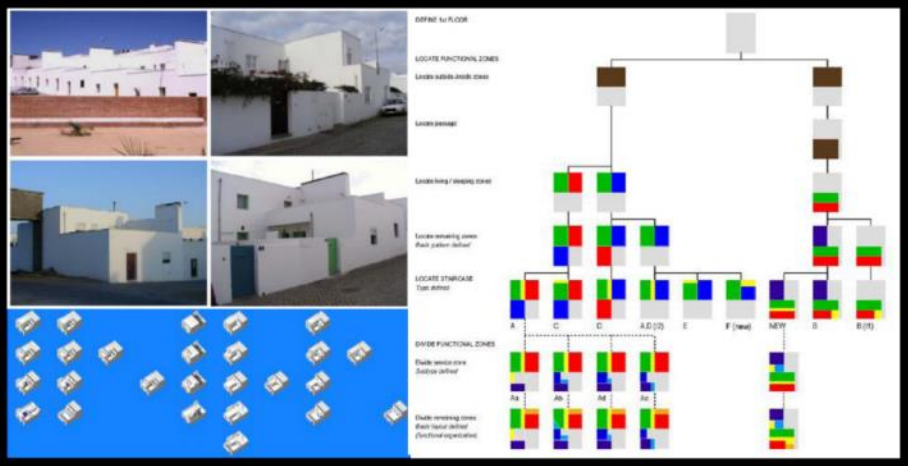


palladian villas grammar _ George Stiny and William Mitchell

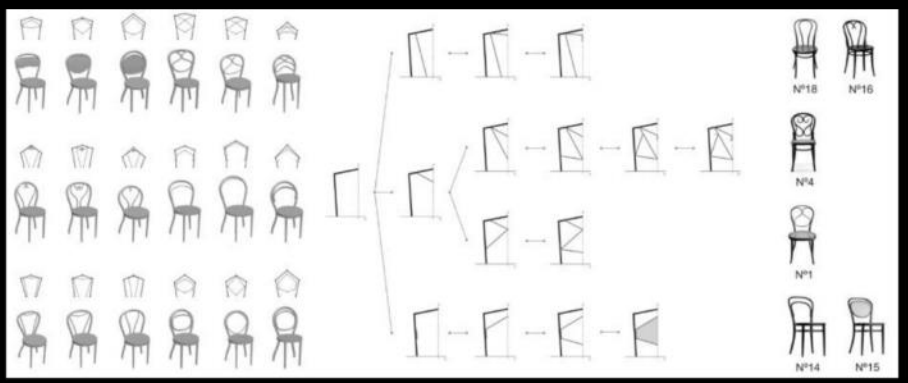


real or fake?

malagueira grammar _ José Pinto Duarte



digital thonet _ Mário Barros



GRAMÁTICAS DE FORMA E GRAMÁTICAS DE TRANSFORMAÇÃO | sara eloy [ISCTE-IUL/ADETTI-IUL]

Analytical grammars

make it possible to understand existing languages

Original grammars

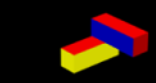
enable new design languages to be created

± color grammar, Terry Knight

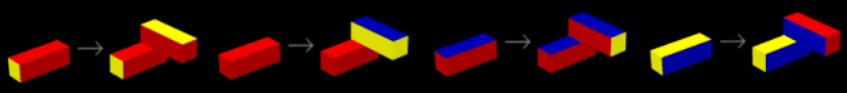
± city maker, José Beirão

± "rabo-de-bacalhau" transformation grammar, Sara Eloy

color grammar _ Terry Knight



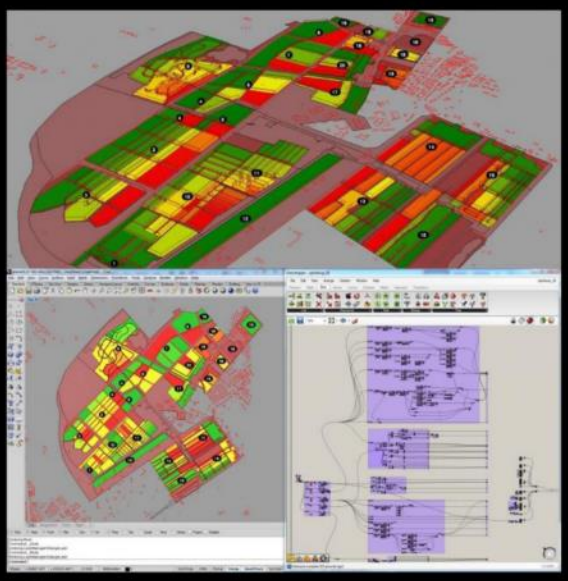
spatial relation



additive rule with 256 different positions

ADETTI-IUL ISTAR-IUL GRAMÁTICAS DE FORMA E GRAMÁTICAS DE TRANSFORMAÇÃO | sara eloy [ISCTE-IUL/ADETTI-IUL]

city maker_ José Beirão



transformation grammar _ Sara Eloy

Analytical grammars

make it possible to understand existing languages

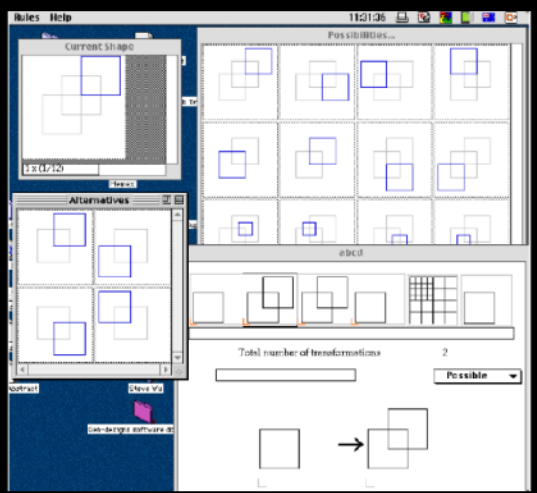
Original grammars

enable new design languages to be created

Grammar interpreters

± interpreters …

Gedit _ Tapia 1996



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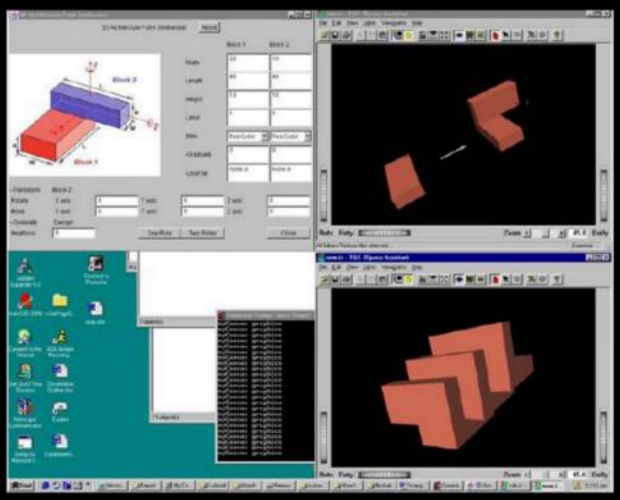
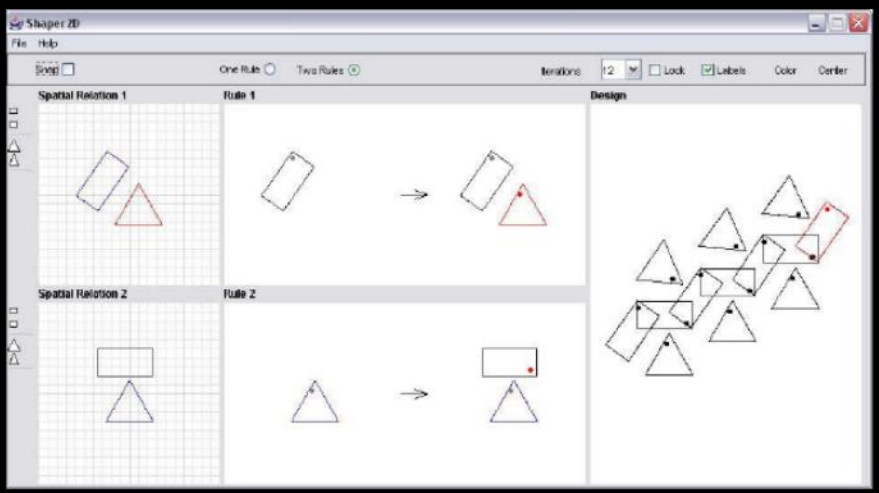
3D shaper _ Wang and Duarte 1998



shaper 2D _ McGill 2001



Analytical grammars

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Original grammars

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+ color grammar, Terry Knight

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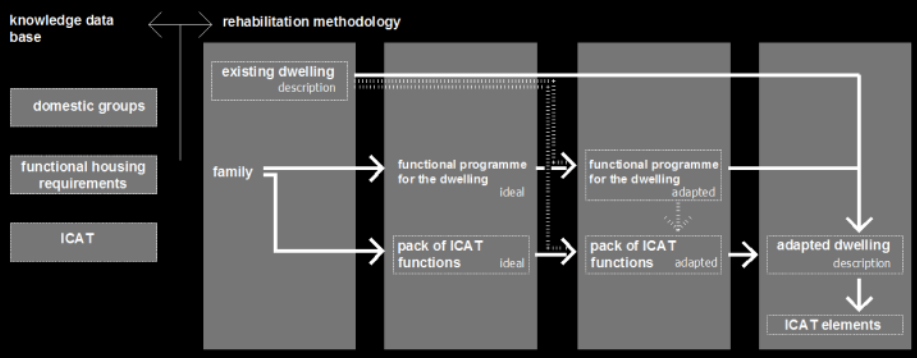
rehabilitation methodology



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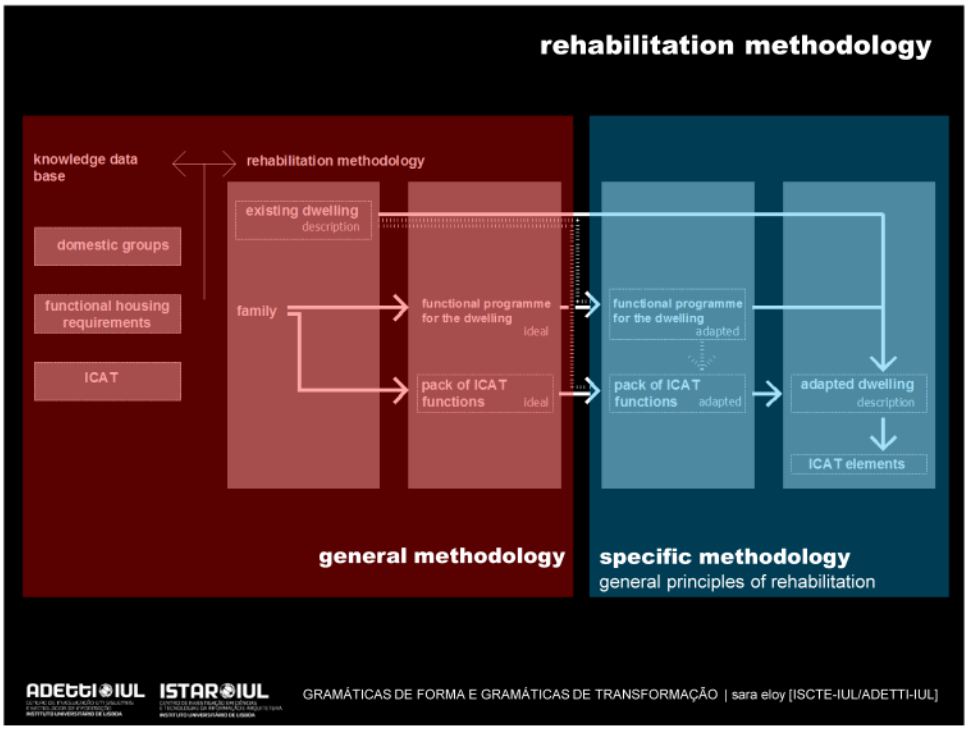
rehabilitation methodology
knowledge data base
rehabilitation methodology
existing dwelling description
domestic groups
functional housing requirements
ICAT
family
functional programme for the dwelling ideal
pack of ICAT functions ideal
functional programme for the dwelling adapted
pack of ICAT functions adapted
adapted dwelling description
ICAT elements
general methodology
specific methodology
general principles of rehabilitation
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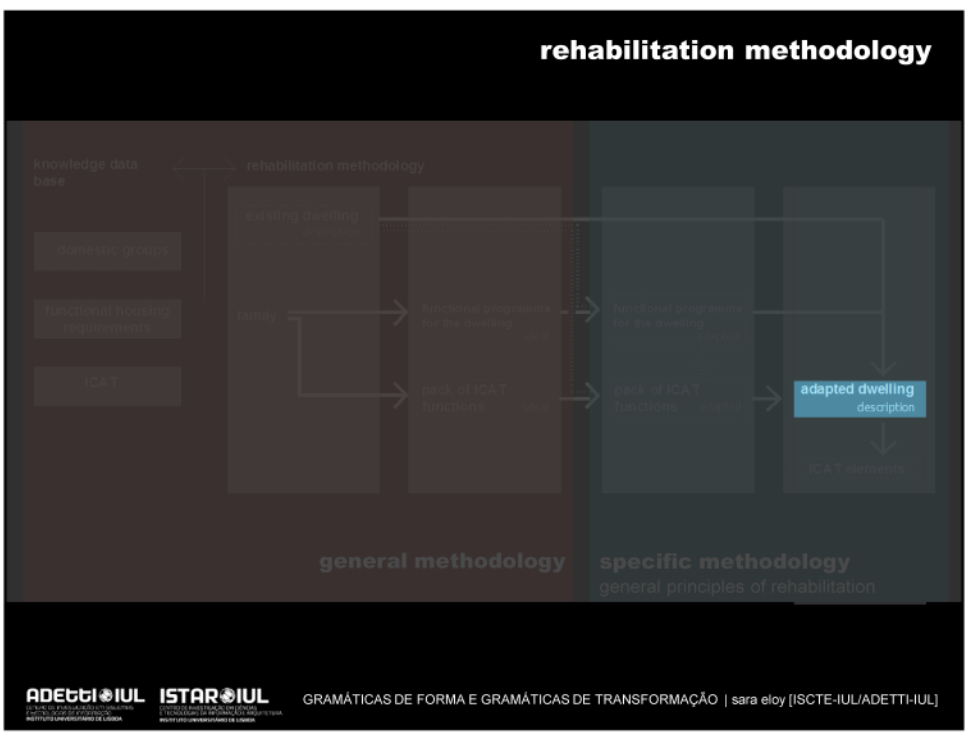
rehabilitation methodology
adapted dwelling description
general methodology
specific methodology
general principles of rehabilitation
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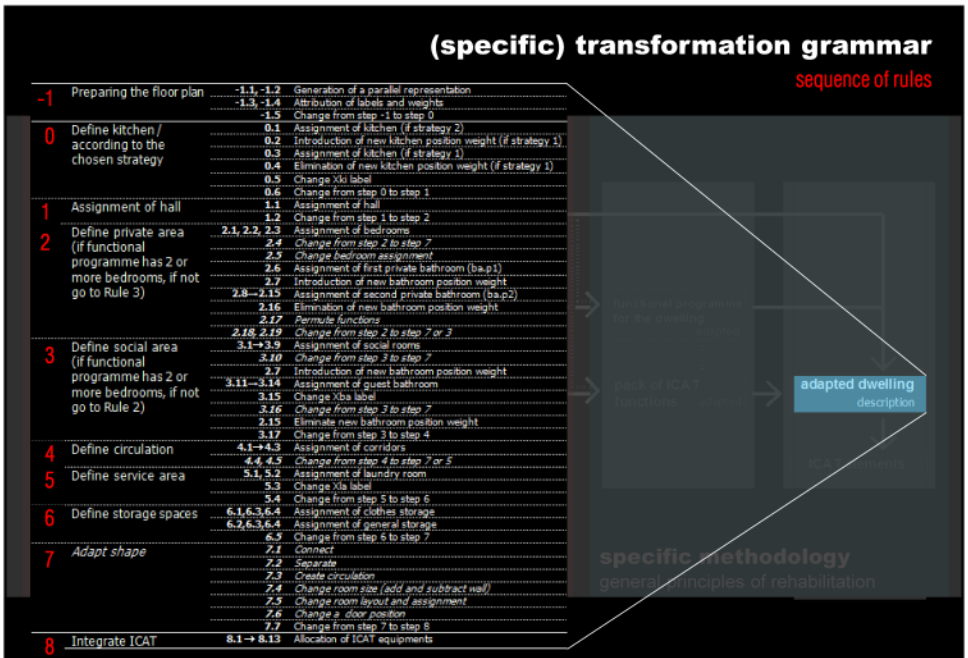
GRAMÁTICAS DE FORMA E GRAMÁTICAS DE TRANSFORMAÇÃO | sara eloy [ISCTE-IUL/ADETTI-IUL]

(specific) transformation grammar

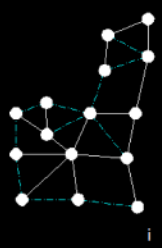
sequence of rules

-1	Preparing the floor plan	-1.1, -1.2	Generation of a parallel representation
		-1.3, -1.4	Attribution of labels and weights
		-1.5	Change from step -1 to step 0
0	Define kitchen / according to the chosen strategy	0.1	Assignment of kitchen (if strategy 2)
		0.2	Introduction of new kitchen position weight (if strategy 1)
		0.3	Assignment of kitchen (if strategy 1)
		0.4	Elimination of new kitchen position weight (if strategy 1)
		0.5	Change Xki label
		0.6	Change from step 0 to step 1
1	Assignment of hall	1.1	Assignment of hall
		1.2	Change from step 1 to step 2
2	Define private area (if functional programme has 2 or more bedrooms, if not go to Rule 3)	2.1, 2.2, 2.3	Assignment of bedrooms
		2.4	*Change from step 2 to step 7*
		2.5	*Change bedroom assignment*
		2.6	Assignment of first private bathroom (ba.p1)
		2.7	Introduction of new bathroom position weight
		2.8→2.15	Assignment of second private bathroom (ba.p2)
		2.16	Elimination of new bathroom position weight
		2.17	*Permute functions*
		2.18, 2.19	*Change from step 2 to step 7 or 3*
3	Define social area (if functional programme has 2 or more bedrooms, if not go to Rule 2)	3.1→3.9	Assignment of social rooms
		3.10	*Change from step 3 to step 7*
		2.7	Introduction of new bathroom position weight
		3.11→3.14	Assignment of guest bathroom
		3.15	Change Xba label
		3.16	*Change from step 3 to step 7*
		2.15	Eliminate new bathroom position weight
		3.17	Change from step 3 to step 4
4	Define circulation	4.1→4.3	Assignment of corridors
		4.4, 4.5	*Change from step 4 to step 7 or 5*
5	Define service area	5.1, 5.2	Assignment of laundry room
		5.3	Change Xla label
		5.4	Change from step 5 to step 6
6	Define storage spaces	6.1,6.3,6.4	Assignment of clothes storage
		6.2,6.3,6.4	Assignment of general storage
		6.5	Change from step 6 to step 7
7	*Adapt shape*	*7.1*	*Connect*
		7.2	*Separate*
		7.3	*Create circulation*
		7.4	*Change room size (add and subtract wall)*
		7.5	*Change room layout and assignment*
		7.6	*Change a door position*
		7.7	Change from step 7 to step 8
8	Integrate ICAT	8.1→8.13	Allocation of ICAT equipments

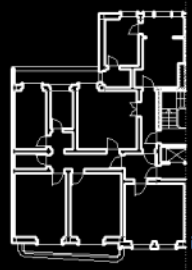


(specific) transformation grammar

elements

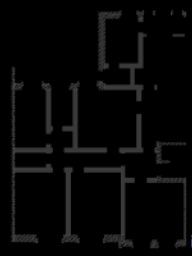


i algebra U02 and U12 with dots and arcs

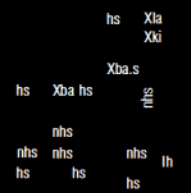


ii algebra U12 with the floor plan

iii algebra U22 with planar surfaces



iv algebra W22 for weights



v algebra V02 for labels

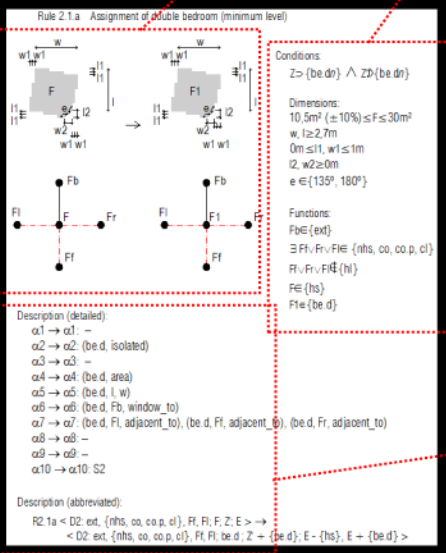
(specific) transformation grammar

type of rules

Shape part

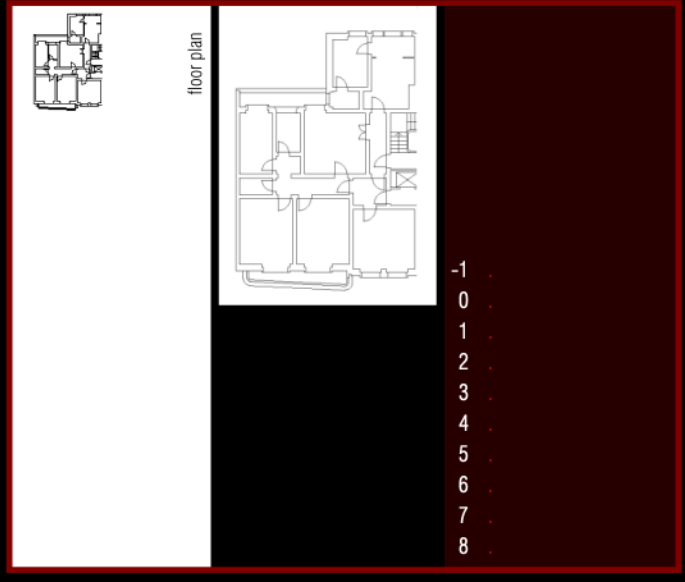
conditions part

description part



- _ Assignment rules
- _ Permuting rules
- _ Rules to divide rooms or eliminate/reduce wall openings (adding walls)
- _ Rules to connect or enlarge rooms (eliminating walls)
- _ Rules for changing the stage in the derivation
- _ Rules for preparing the floor plan
- _ Rules for integrating ICAT elements

sample transformation

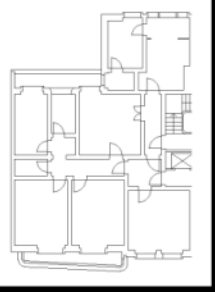


ADEttI IUL ISTAR IUL GRAMÁTICAS DE FORMA E GRAMÁTICAS DE TRANSFORMAÇÃO | sara eloy [ISCTE-IUL/ADETTI-IUL]

sample transformation

floor plan

spatial void



#1

-1 preparing the floor plan
0 .
1 .
2 .
3 .
4 .
5 .
6 .
7 .
8 .

Rules -1.1

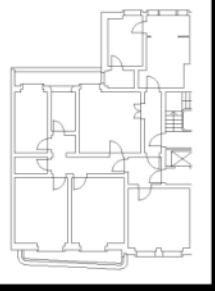
Creation of a compound representation

sample transformation

floor plan

spatial void

graphs



#2

-1 preparing the floor plan
0 .
1 .
2 .
3 .
4 .
5 .
6 .
7 .
8 .

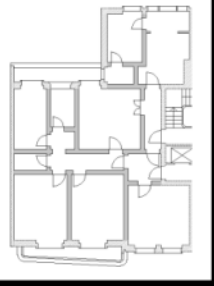
Rules -1.2

Creation of a compound representation

sample transformation




floor plan
spatial void
graphs
weights



Rules -1.3

Insertion of weights

#3

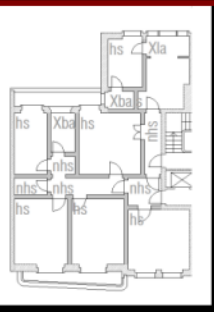
-1 preparing the floor plan
0 .
1 .
2 .
3 .
4 .
5 .
6 .
7 .
8 .

sample transformation





floor plan
spatial void
graphs
weights
labels



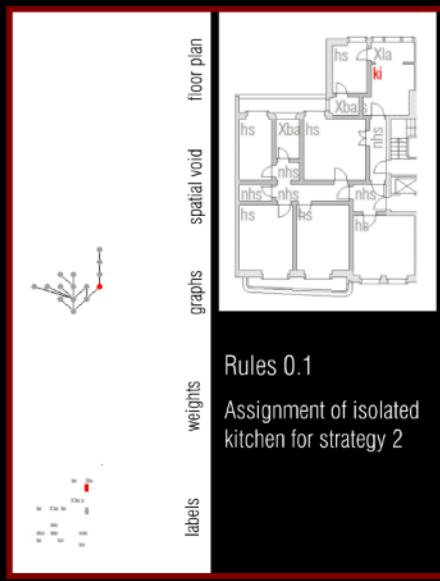
Rules -1.4

Insertion of labels

#4

-1 preparing the floor plan
0 .
1 .
2 .
3 .
4 .
5 .
6 .
7 .
8 .

sample transformation



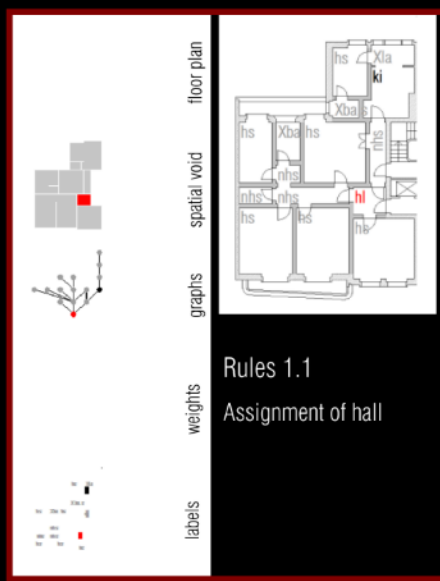
#5

Rules 0.1

Assignment of isolated kitchen for strategy 2

-1 .
0 defining kitchen
1 .
2 .
3 .
4 .
5 .
6 .
7 .
8 .

sample transformation



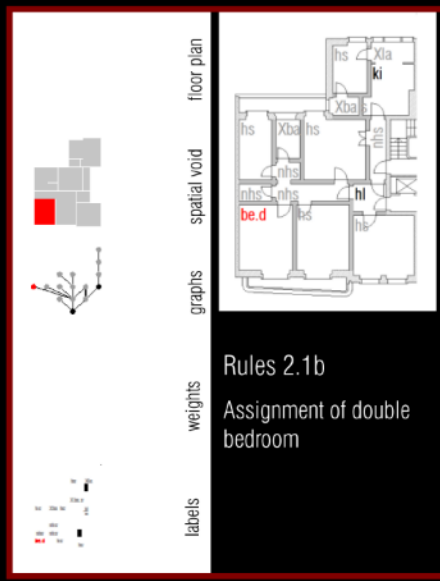
#6

Rules 1.1

Assignment of hall

-1 .
0 .
1 assigment of hall
2 .
3 .
4 .
5 .
6 .
7 .
8 .

sample transformation



floor plan
spatial void
graphs
weights
labels

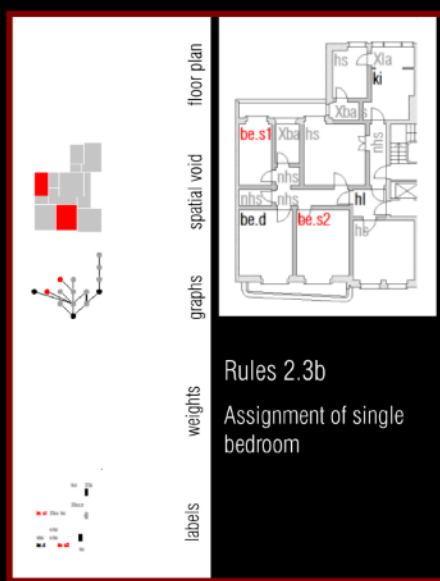
Rules 2.1b

Assignment of double bedroom

#7

-1 .
0 .
1 .
2 defining private area
3 .
4 .
5 .
6 .
7 .
8 .

sample transformation



floor plan
spatial void
graphs
weights
labels

Rules 2.3b

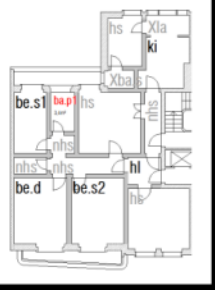
Assignment of single bedroom

#8

-1 .
0 .
1 .
2 defining private area
3 .
4 .
5 .
6 .
7 .
8 .

sample transformation

floor plan
spatial void
graphs
weights
labels



#9

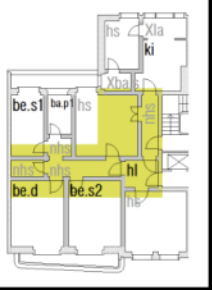
Rules 2.6

Assignment of main private bathroom

-1 .
0 .
1 .
2 defining private area
3 .
4 .
5 .
6 .
7 .
8 .

sample transformation

floor plan
spatial void
graphs
weights
labels



#10

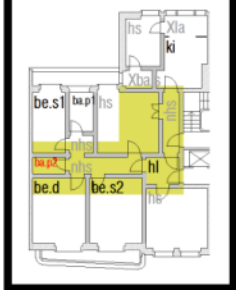
Rules 2.7a

Attribution of new bathroom placement weight (type a and b)

-1 .
0 .
1 .
2 defining private area
3 .
4 .
5 .
6 .
7 .
8 .

sample transformation

floor plan
spatial void
graphs
weights
labels



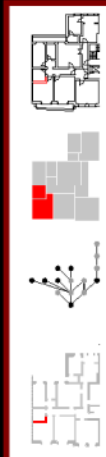
#11

Rules 2.8b

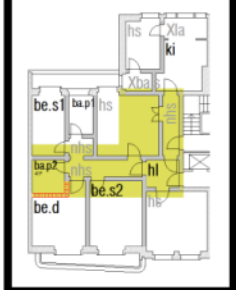
Assignment of second private bathroom

-1 .
0 .
1 .
2 defining private area
3 .
4 .
5 .
6 .
7 .
8 .

sample transformation



floor plan
spatial void
graphs
weights
labels



#12

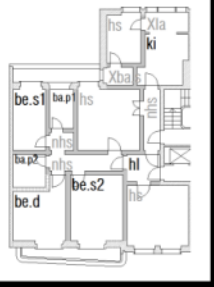
Rules 7.4b

Changing a room's dimension (enlarging or reducing) by moving a wall

-1 .
0 .
1 .
2 .
3 .
4 .
5 .
6 .
7 adapt shape
8 .

sample transformation

floor plan
spatial void
graphs
weights
labels



#13

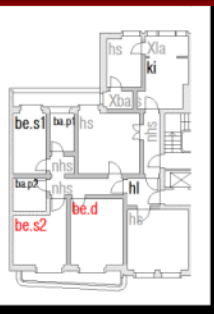
Rules 2.16a

Erasing the new bathroom placement weight (type a and b)

-1 .
0 .
1 .
2 defining private area
3 .
4 .
5 .
6 .
7 .
8 .

sample transformation

floor plan
spatial void
graphs
weights
labels



#14

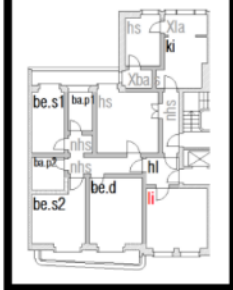
Rules 2.5

Permuting bedroom assignment due to area criteria

-1 .
0 .
1 .
2 defining private area
3 .
4 .
5 .
6 .
7 .
8 .

sample transformation

floor plan
spatial void
graphs
weights
labels



#15

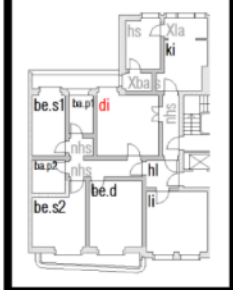
Rules 3.1a

Assignment of living room

-1 .
0 .
1 .
2 .
3 defining social area
4 .
5 .
6 .
7 .
8 .

sample transformation

floor plan
spatial void
graphs
weights
labels



#16

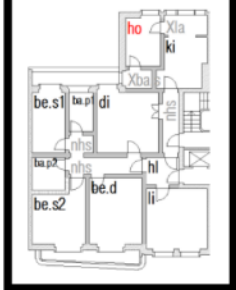
Rules 3.2b

Assignment of dining room

-1 .
0 .
1 .
2 .
3 defining social area
4 .
5 .
6 .
7 .
8 .

sample transformation

#17



floor plan
spatial void
graphs
weights
labels

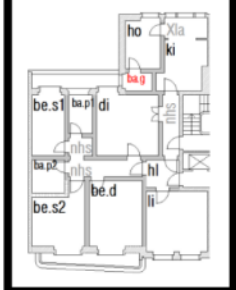
Rules 3.4

Assignment of isolated home office

-1 .
0 .
1 .
2 .
3 defining social area
4 .
5 .
6 .
7 .
8 .

sample transformation

#18



floor plan
spatial void
graphs
weights
labels

Rules 3.11

Assignment of guest bathroom

-1 .
0 .
1 .
2 .
3 defining social area
4 .
5 .
6 .
7 .
8 .

sample transformation

floor plan

spatial void

#19

graphs

-1 .
0 .
1 .
2 .
3 .
4 .
5 .
6 .
7 adapt shape
8 .

weights

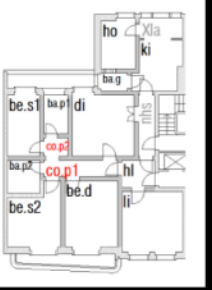
Rules 7.6d

Changing a door position (change door to a perpendicular wall)

labels

sample transformation

floor plan



spatial void

#20

graphs

-1 .
0 .
1 .
2 .
3 .
4 defining circulation
5 .
6 .
7 .
8 .

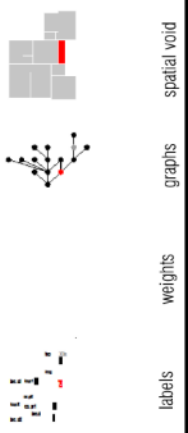
weights

Rules 4.1

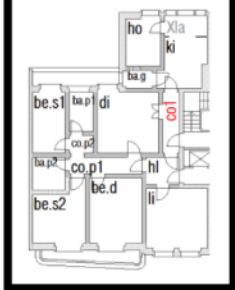
Assignment of private corridors

labels

sample transformation



floor plan
spatial void
graphs
weights
labels



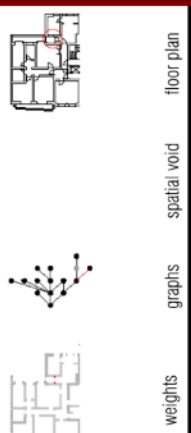
#21

Rules 4.2

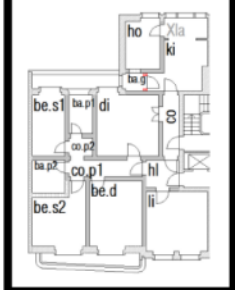
Assignment of corridors

-1 .
0 .
1 .
2 .
3 .
4 defining circulation
5 .
6 .
7 .
8 .

sample transformation



floor plan
spatial void
graphs
weights
labels



#22

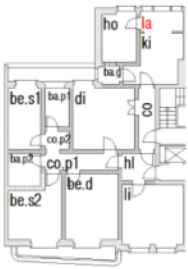
Rules 7.3b

Remove part of a room area to assign to circulation area

-1 .
0 .
1 .
2 .
3 .
4 .
5 .
6 .
7 adapt shape
8 .

sample transformation

floor plan
spatial void
graphs
weights
labels



Rules 5.1

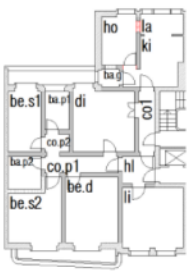
Assignment of isolated laundry

#23

-1 .
0 .
1 .
2 .
3 .
4 .
5 defining service areas
6 .
7 .
8 .

sample transformation

floor plan
spatial void
graphs
weights
labels



Rules 7.6

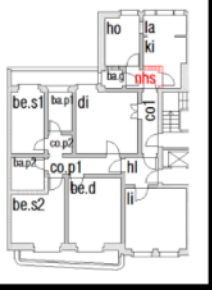
Change door position (change door to a perpendicular wall)

#24

-1 .
0 .
1 .
2 .
3 .
4 .
5 .
6 .
7 adapt shape
8 .

sample transformation

floor plan



spatial void

graphs

weights

labels

Rules 7.3a

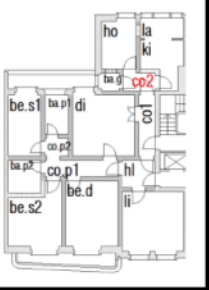
Remove part of a room to assign to circulation area

#25

-1 .
0 .
1 .
2 .
3 .
4 .
5 .
6 .
7 adapt shape
8 .

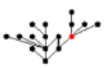
sample transformation

floor plan



spatial void

graphs



weights

labels

Rules 4.2

Assignment of social corridor

#26

-1 .
0 .
1 .
2 .
3 .
4 defining circulation
5 .
6 .
7 .
8 .

sample transformation

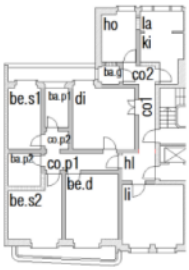
floor plan

spatial void

graphs

weights

labels



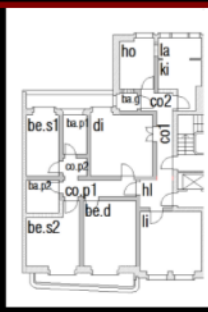
#27

Rules 7.1i

Widening the connection between two rooms /by partially eliminating walls on both sides of a door opening)

-1 .
0 .
1 .
2 .
3 .
4 .
5 .
6 .
7 adapt shape
8 .

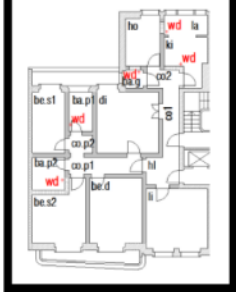
sample transformation



-1 .
0 .
1 .
2 .
3 .
4 .
5 .
6 .
7 .
8 .

sample transformation

floor plan



spatial void

graphs

Rules 8.1a

Allocating of water detectors

weights

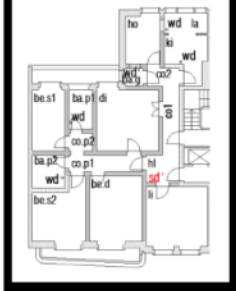
labels

#28

-1 .
0 .
1 .
2 .
3 .
4 .
5 .
6 .
7 .
8 Integration of ICAT

sample transformation

floor plan



spatial void

graphs

Rules 8.1b

Allocating of smoke detectors

weights

labels

#29

-1 .
0 .
1 .
2 .
3 .
4 .
5 .
6 .
7 .
8 Integration of ICAT

ADEttI IUL ISTAR IUL GRAMÁTICAS DE FORMA E GRAMÁTICAS DE TRANSFORMAÇÃO | sara eloy [ISCTE-IUL/ADETTI-IUL]

sample transformation

floor plan

graphs

weights

labels

spatial void

Rules 8.1c

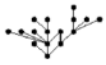
Allocating of temperature detectors

#30

-1 .
0 .
1 .
2 .
3 .
4 .
5 .
6 .
7 .
8 Integration of ICAT

sample transformation

floor plan

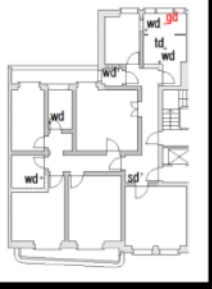


graphs

weights

labels

spatial void



Rules 8.1d

Allocating of gas detectors

#31

-1 .
0 .
1 .
2 .
3 .
4 .
5 .
6 .
7 .
8 Integration of ICAT

sample transformation

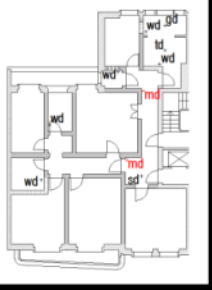
floor plan

spatial void

graphs

weights

labels



#32

Rules 8.1d

Allocating of movement detectors (for the hall and corridors with door to the exterior)

-1 .
0 .
1 .
2 .
3 .
4 .
5 .
6 .
7 .
8 Integration of ICAT

sample transformation

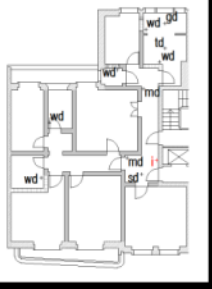
floor plan

spatial void

graphs

weights

labels



#33

Rules 8.10a1

Allocating of interfaces: control panel

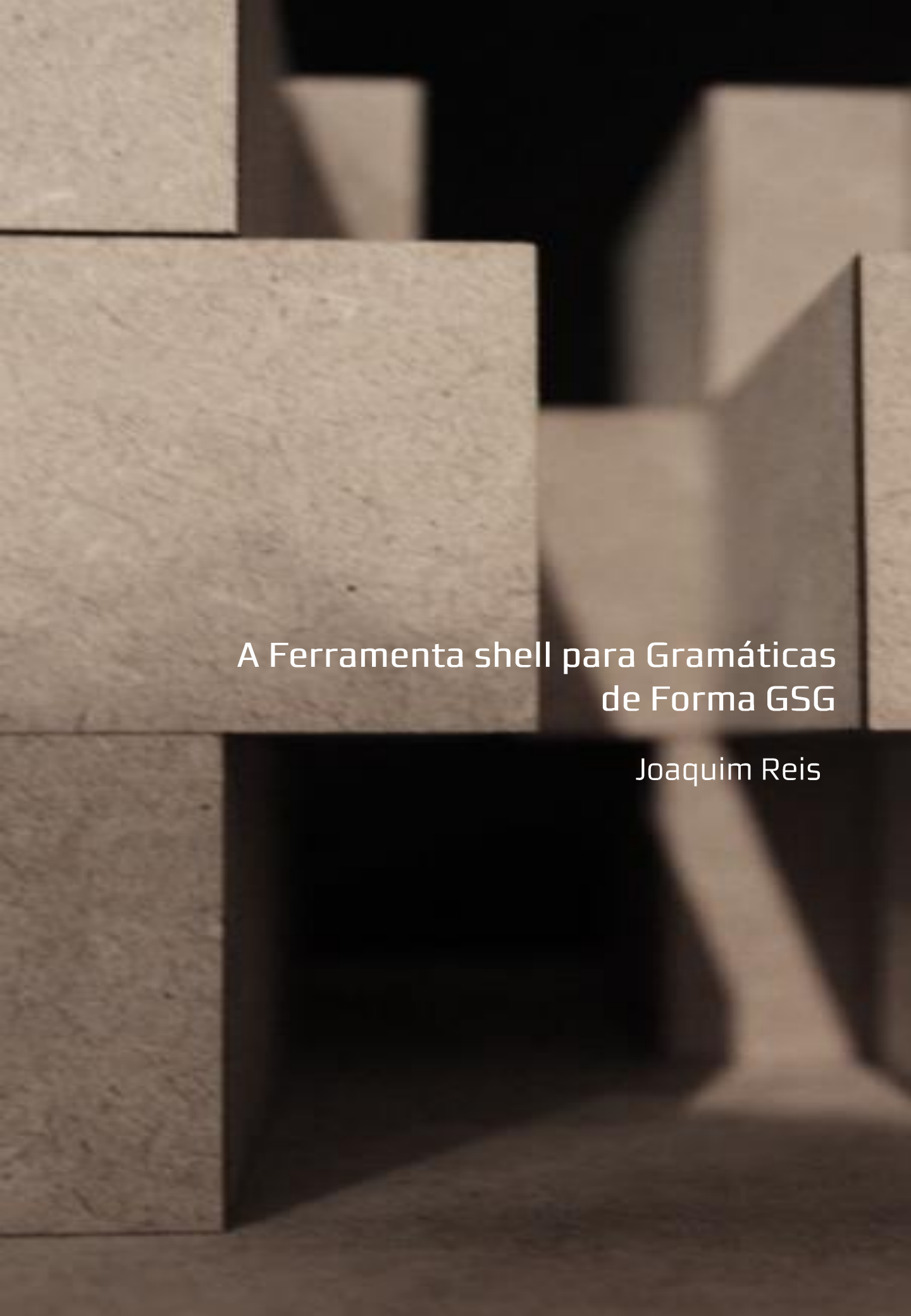
-1 .
0 .
1 .
2 .
3 .
4 .
5 .
6 .
7 .
8 Integration of ICAT

Shape Grammar | Advantages

_ Optimization
_ Systemization
_ Generative power
_ Diversity
_ Capture design language
_ Structured formulation that allows computer implementation
_ Reduction of design errors

Gramáticas de forma e gramáticas de transformação

Sara Eloy
sara.eloy@iscte.pt



A Ferramenta shell para Gramáticas de Forma GSG

Joaquim Reis

a ferramenta *shell* para gramáticas de forma GSG

Joaquim Reis

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GFTU - Gramáticas de Forma para Transformação Urbana,
21 de Abril de 2014, ADETTI / ISTAR-IUL, ISCTE-IUL

plan

- shape grammars & examples
- shape emergence & maximal shapes
- computation with shapes

- the GSG project
  - computational architecture
  - shape operations & examples & testing
  - shape representation & main classes
  - shape ioe & interface
- work in progress & future work

shape grammars

(Stiny & Gips 1972) (Stiny 1980)

- Shape Grammars (SG) describe recursive **computations with shapes**
- SGs are **visual**
- Can be used to represent **styles**
- Based on production **rules**

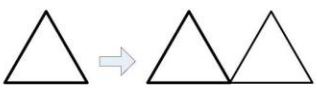
<shape-to-match> **==>** ***<substitution-shape>***

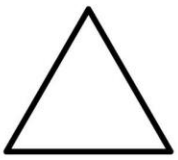
pre-condition *action*

elements of a SG:

- **vocabulary** of shapes, *e.g.*, points, lines, 2D, 3D shapes (may include dimensions, colors)
- **rules** of the grammar
- **initial shape**

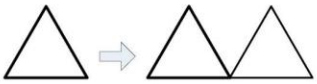
example

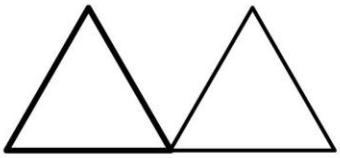




1

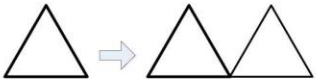
example

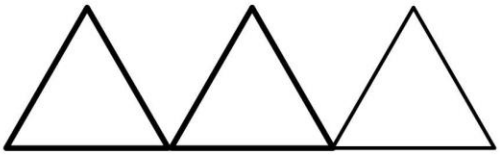




2

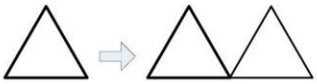
example

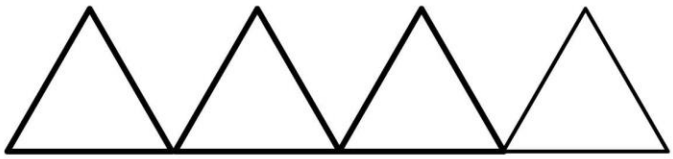




3

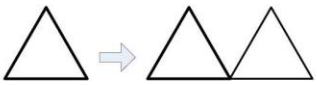
example

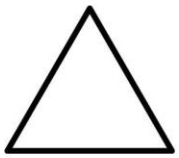




4

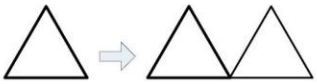
example
(with shape emergence ?)

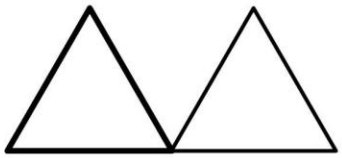




1

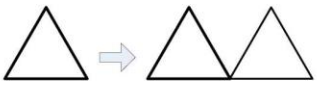
example
(with shape emergence ?)

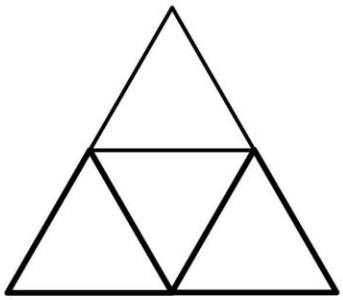




2

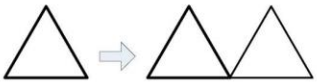
example
(with shape emergence ?)

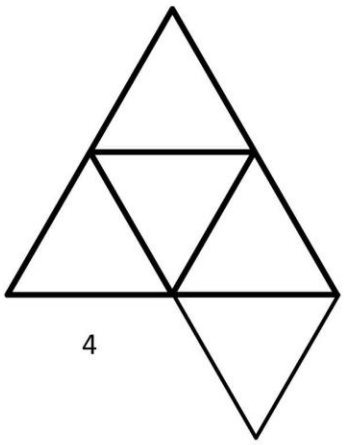




3

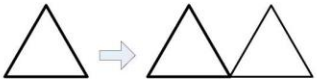
example
(with shape emergence ?)

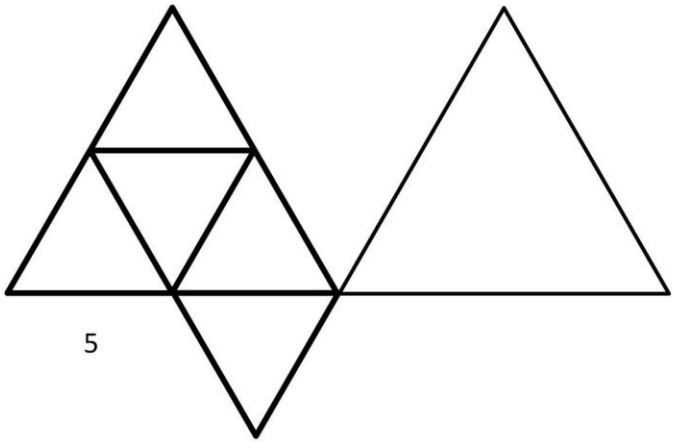




4

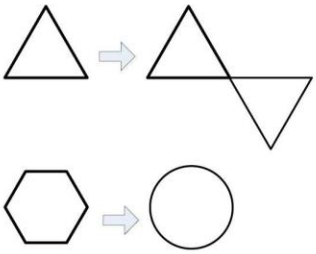
example
(with shape emergence ?)

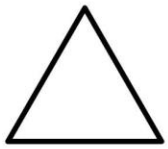




5

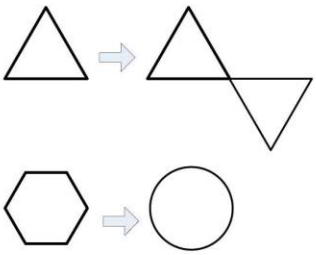
example
with shape emergence

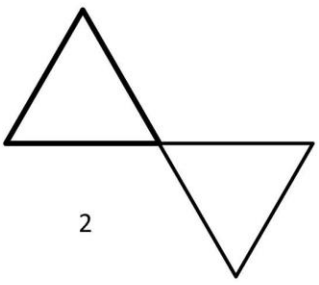




1

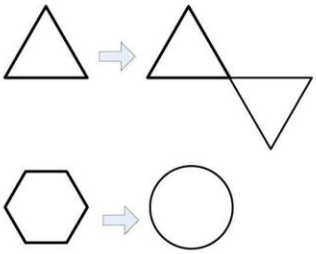
example
with shape emergence

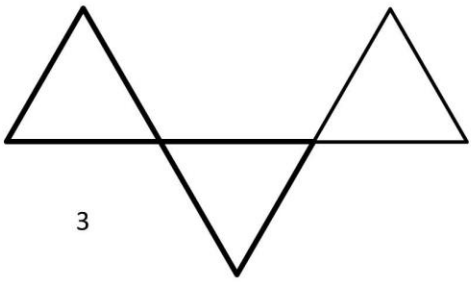




2

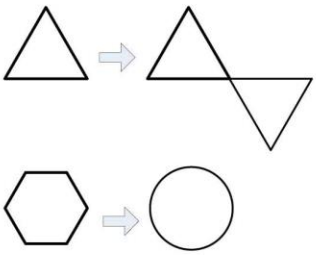
example
with shape emergence

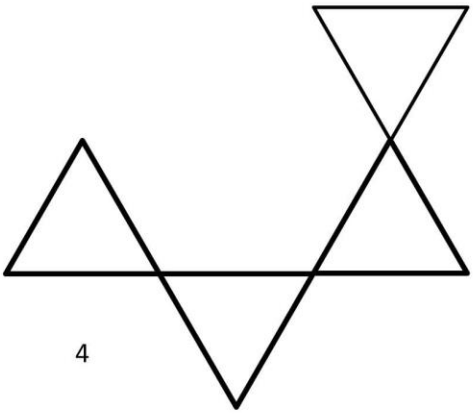




3

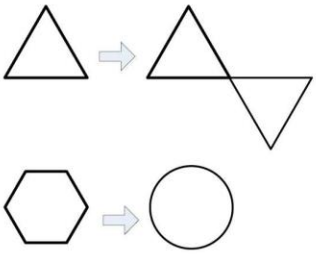
example
with shape emergence

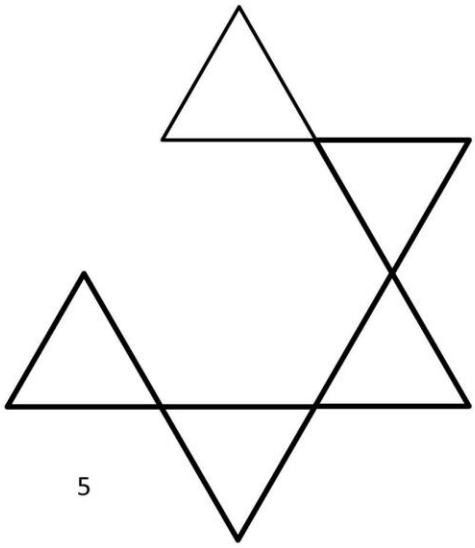




4

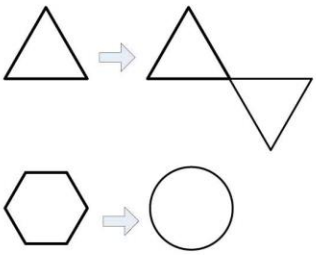
example
with shape emergence

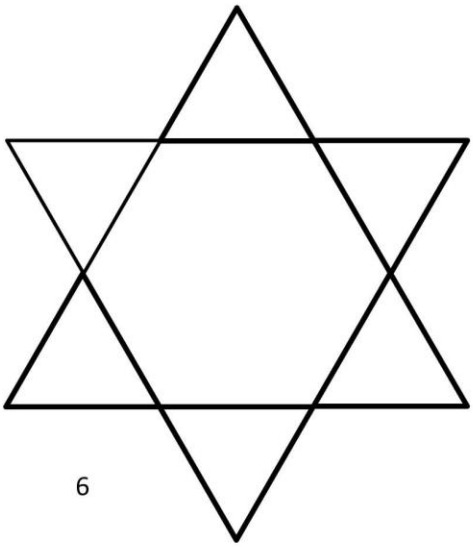




5

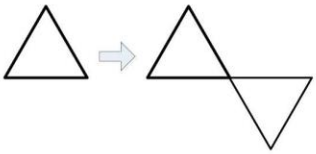
example
with shape emergence

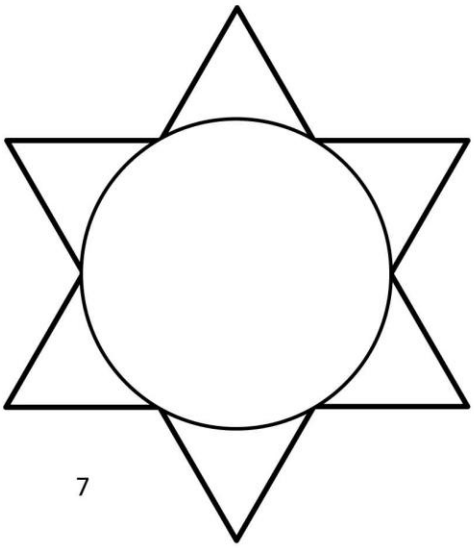




6

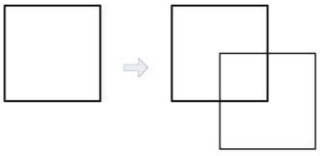
example
with shape emergence

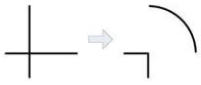


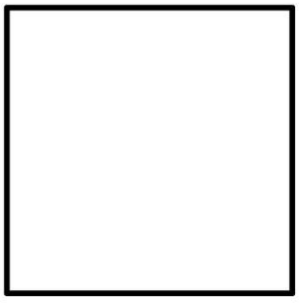


7

example
with shape emergence

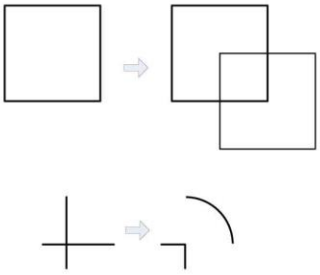


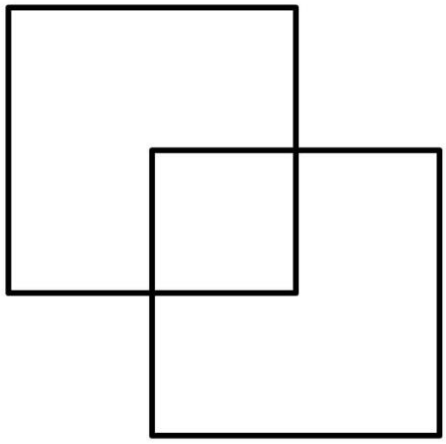




1

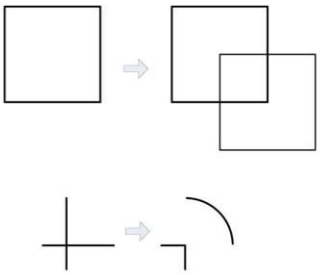
example
with shape emergence

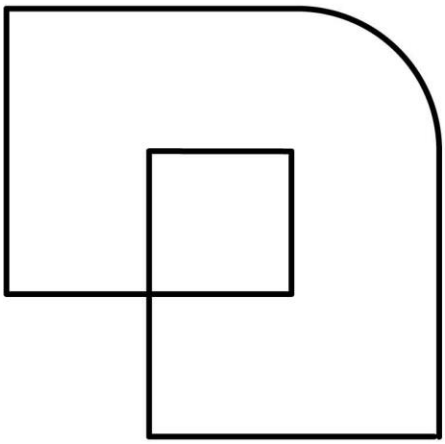




2

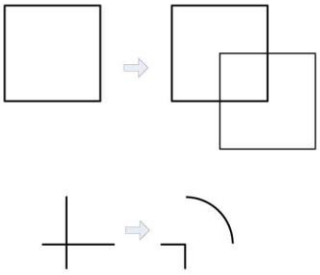
example
with shape emergence

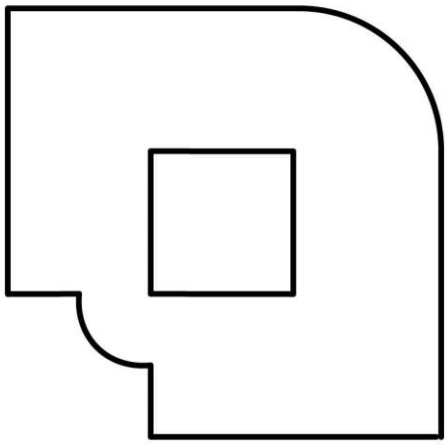




3

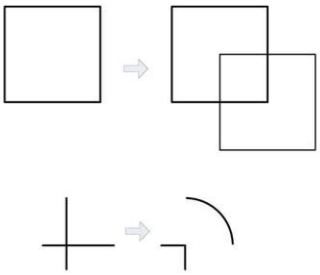
example
with shape emergence

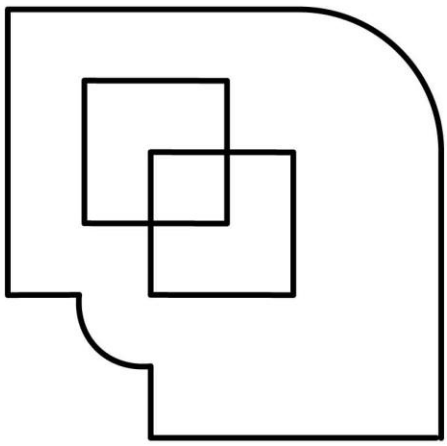




4

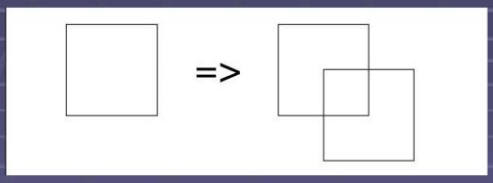
example
with shape emergence

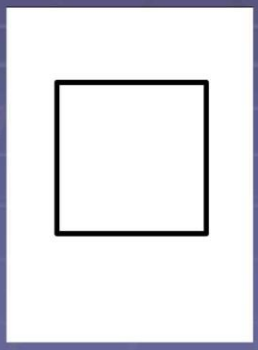




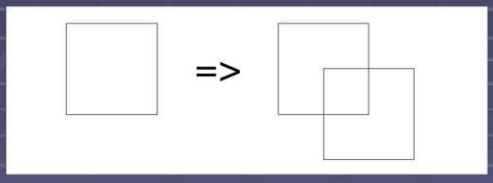
5

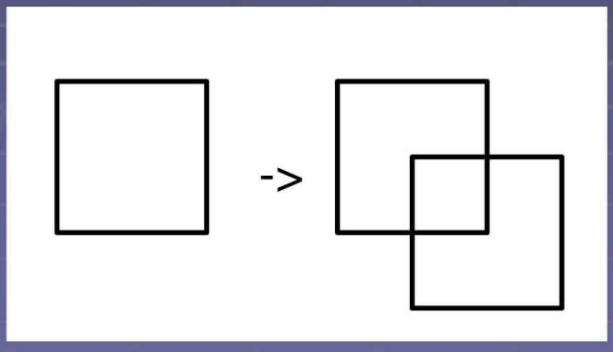
shape emergence
(a closer look)





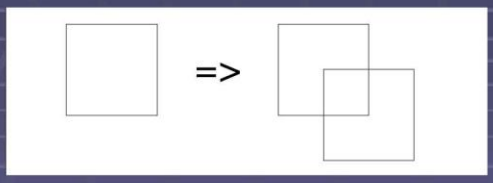
shape emergence
(a closer look)

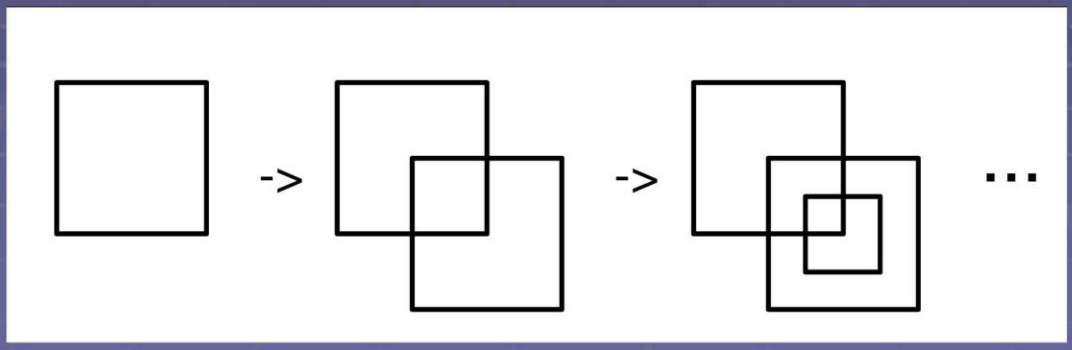




shape emergence

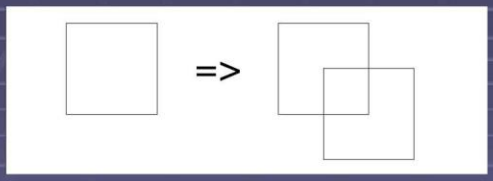
(a closer look)

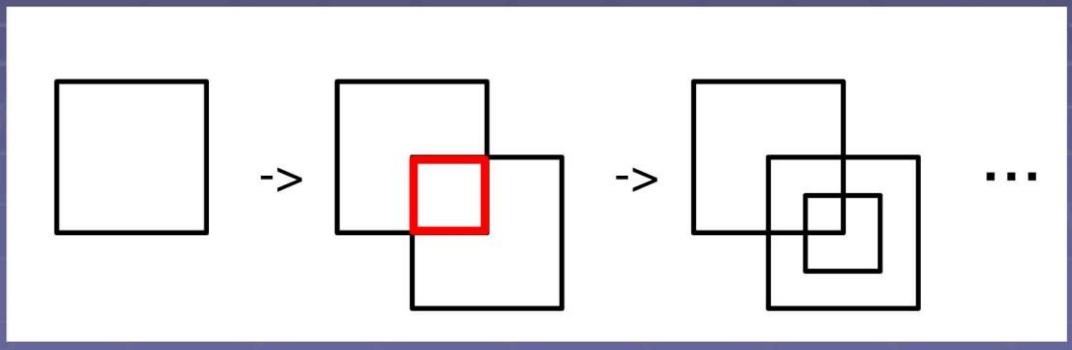




shape emergence

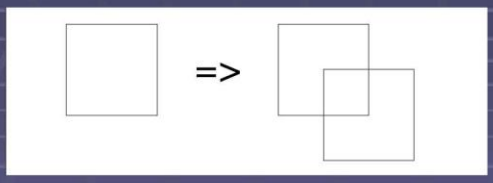
(a closer look)



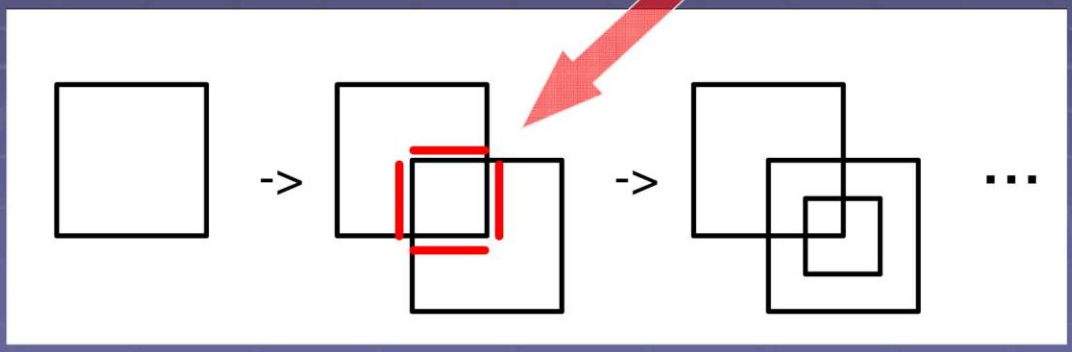


shape emergence

(a closer look)

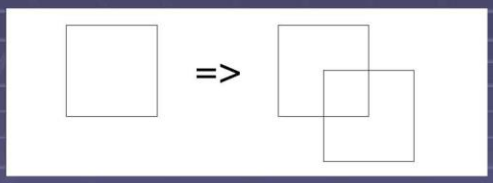


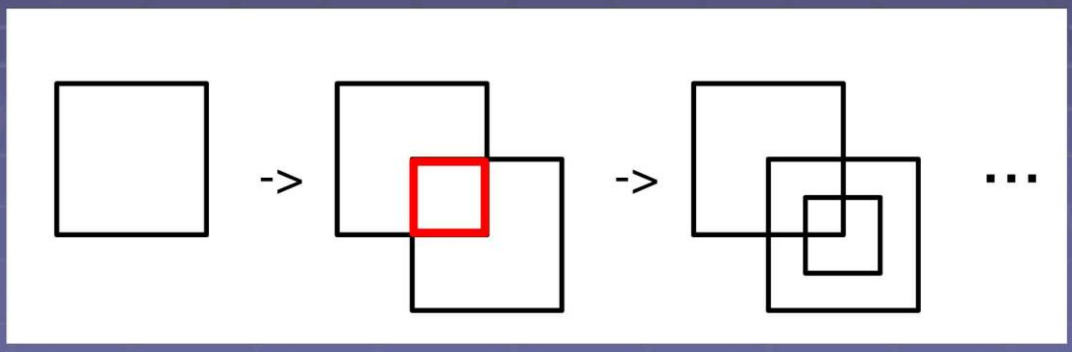
recognized as (embedded) lines



shape emergence

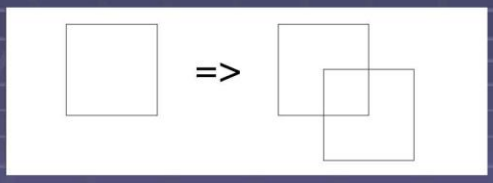
(a closer look)

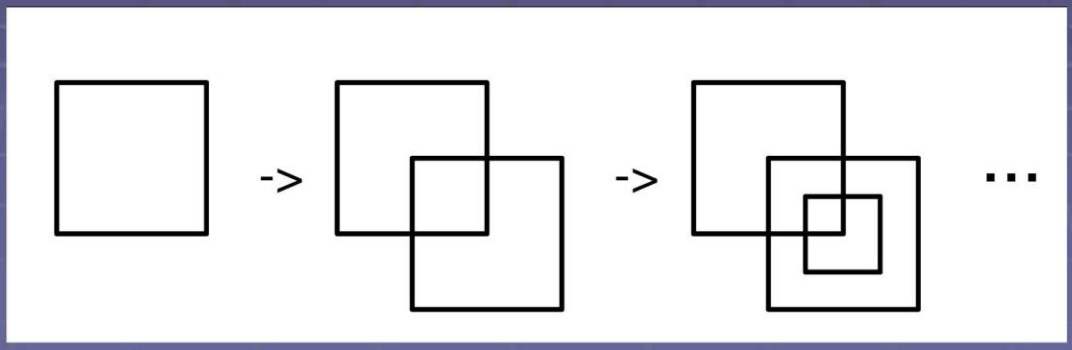




shape emergence

(a closer look)





maximal shape

(Stiny & Gips 1972) (Stiny 1980)

- **maximal shape** representation - a finite set of **shape elements** (points, lines, planes, solids, ...) that are **maximal** in combination with each other (*i.e.*, with no overlap).
  - each particular shape has a **unique** maximal representation
  - maximal representation accomodates for **shape emergence**

  shape elements are maximal and each represents an infinite number of smaller possible elements contained in them
    - a maximal line represents an infinite set of points and lines
    - a maximal plane represents an infinite set of points, lines and planes
    - a maximal solid represents an infinite set of points, lines, planes and solids
    - ...
- **algebras** U_{ij} for maximal shapes define shape operations: **+** (shape union), **-** (shape difference), ***** (shape intersection) and **≤** (sub-shape)

mechanics of
shape computation
with rules

rule: $A \Longrightarrow B$

applicable to C if: $T(A) \leq C$

after application C' is: $(C - T(A)) + T(B)$

C - a design, or composition
T - a geometric transformation (rotation, translation, scale, mirror)

GSG
generic Shape Grammars
(Reis 2011, 2011)

- a **tool** for building **computational systems** to support work in

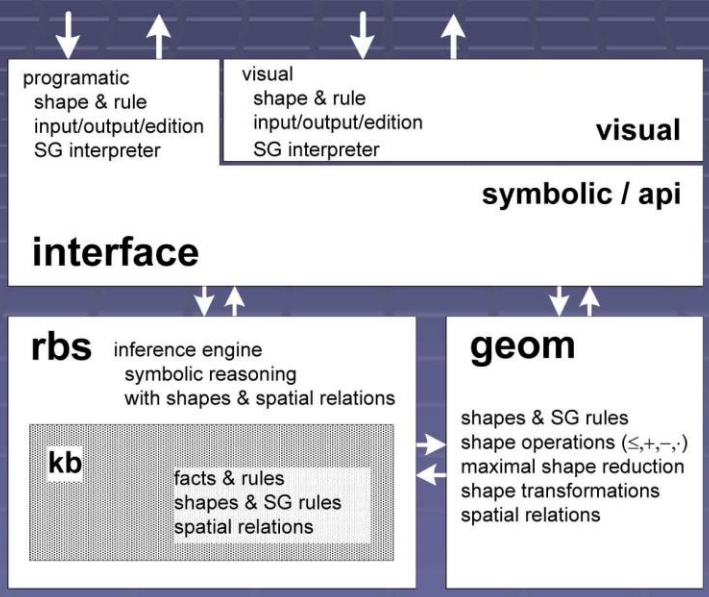
  design,
  architecture
  art

  based on **shape grammars**

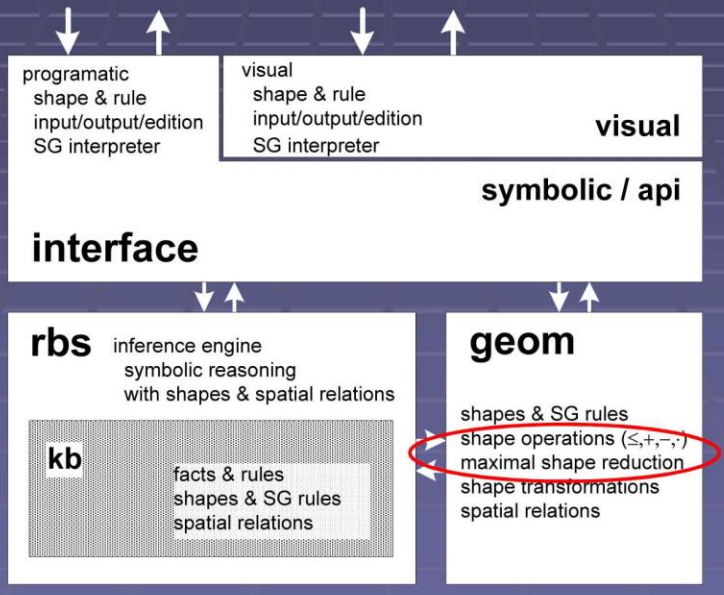
- intelligent rule-based systems
- interfaces
- computational geometry

for past work see papers (Reis 2006-2013)

GSG architecture



shape operations

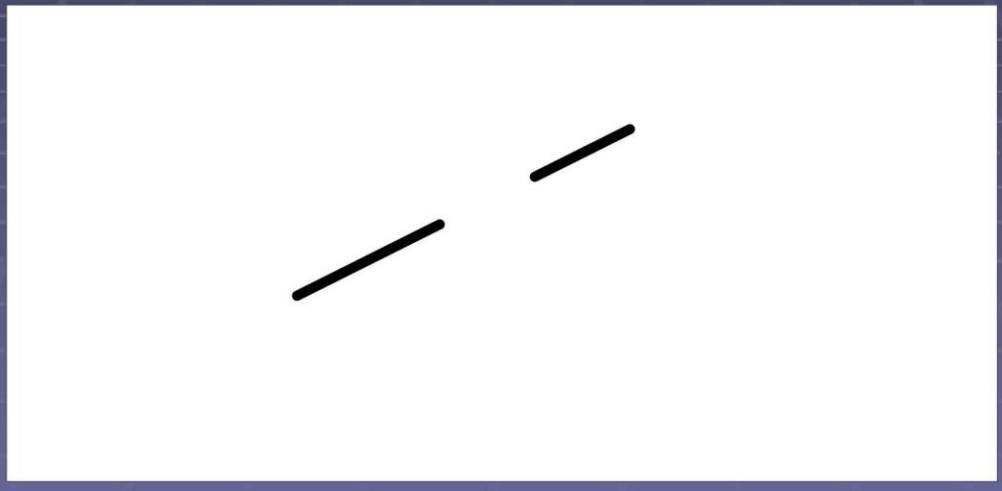


non-maximal shape algebras U_{12}

- non-maximal shape operations
  + (union, sum)
  - (difference, subtraction)
  * (intersection, multiplication)
  ≤ (sub-shape, inclusion)
- shapes are sets of lines
- no potential for shape emergence
- examples with shapes with co-linear lines

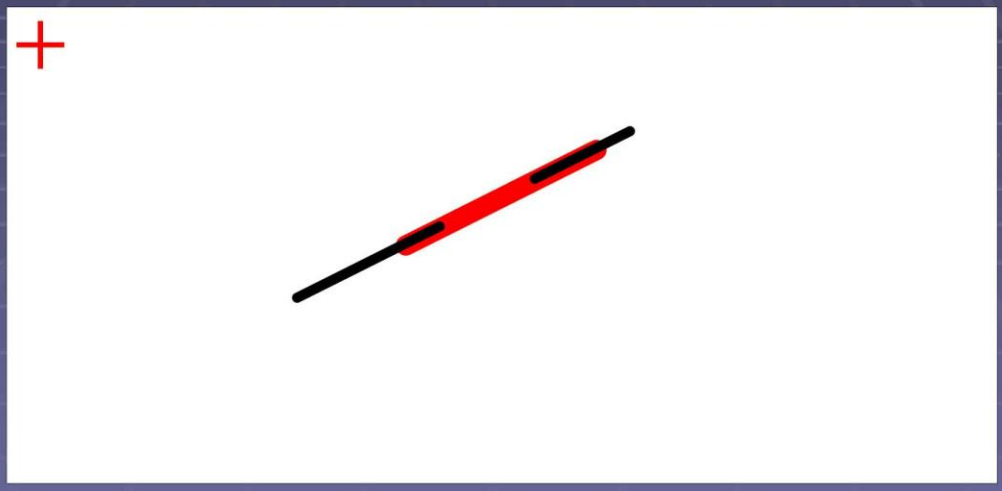
non-maximal shape operations

example with (colinear) non-maximal lines, union



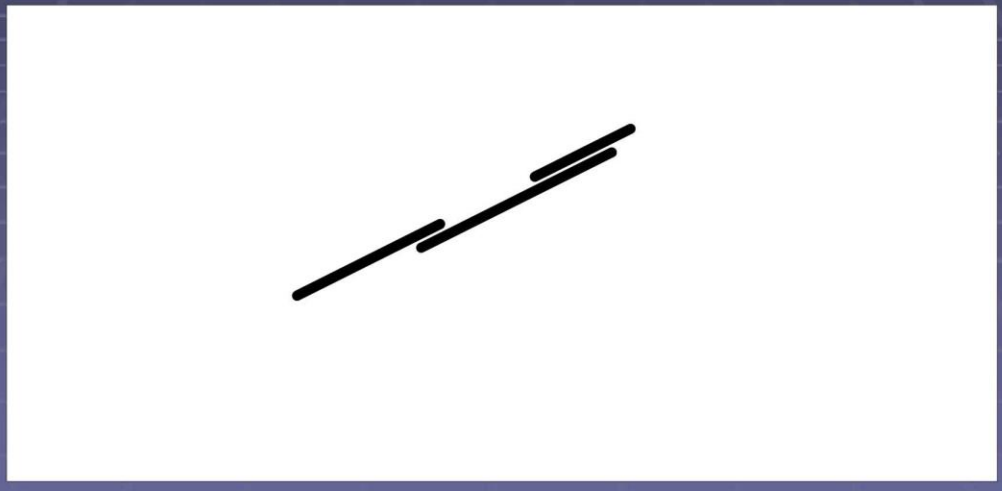
non-maximal shape operations

example with (colinear) non-maximal lines, union



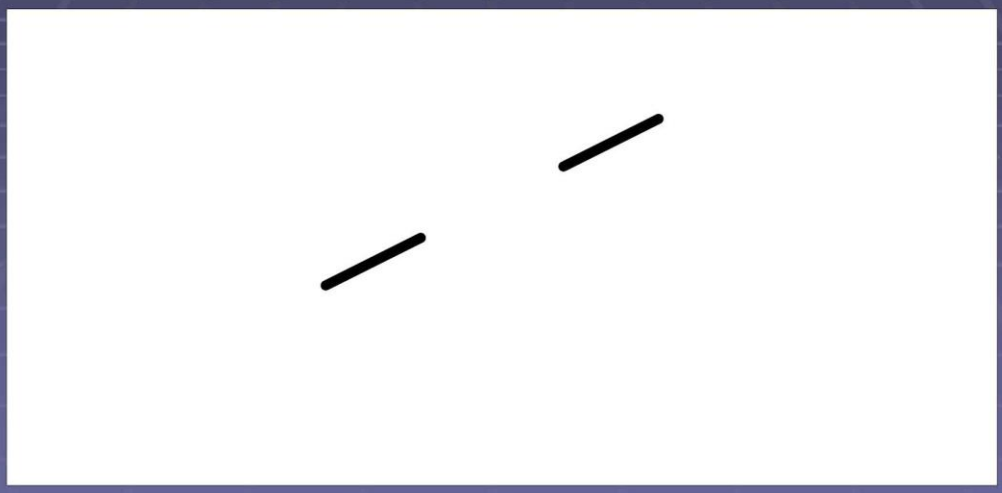
non-maximal shape operations

example with (colinear) non-maximal lines, union



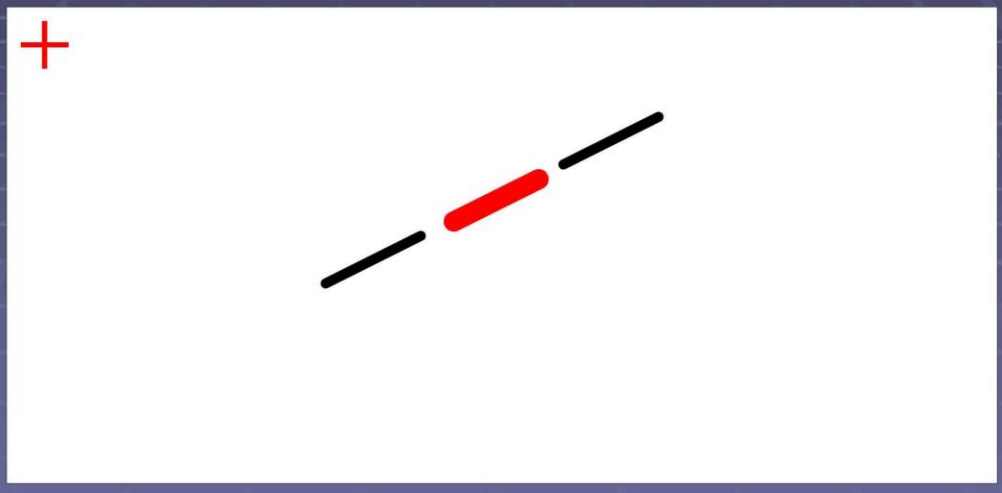
non-maximal shape operations

example with (colinear) non-maximal lines, union



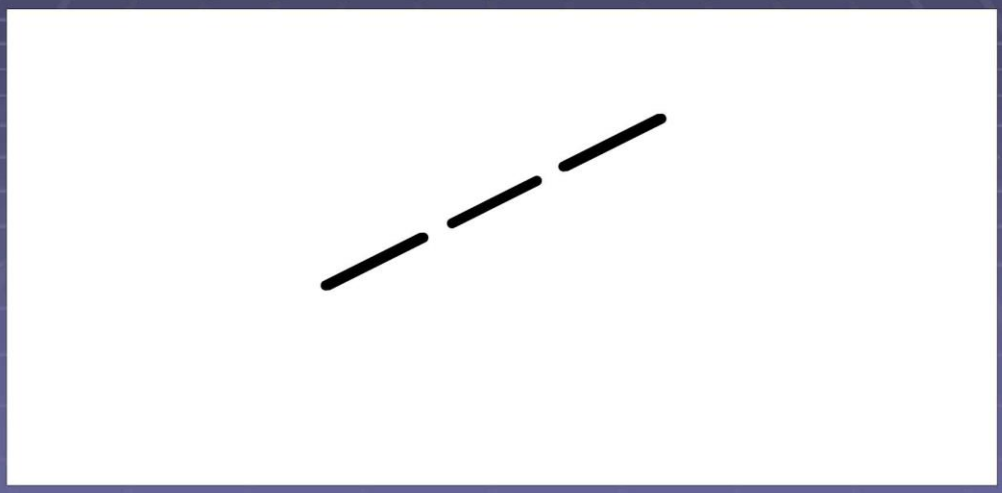
non-maximal shape operations

example with (colinear) non-maximal lines, union



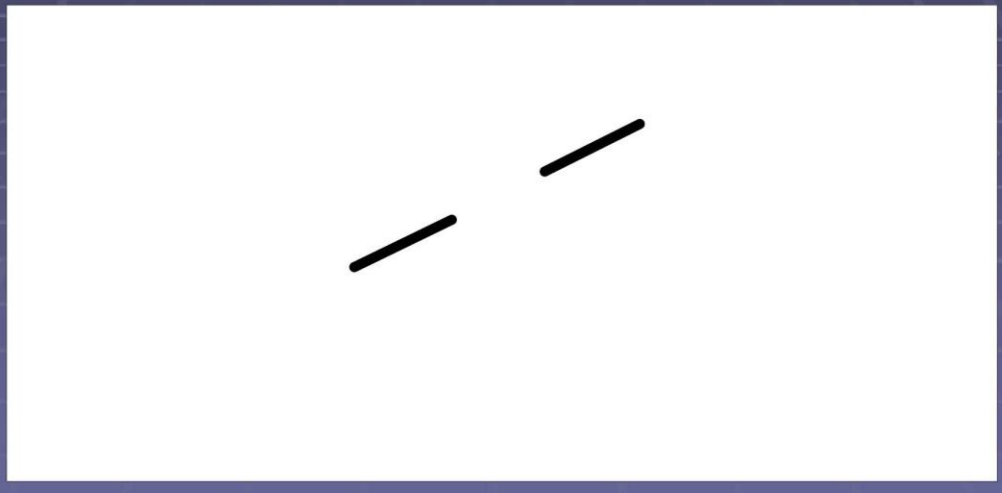
non-maximal shape operations

example with (colinear) non-maximal lines, union



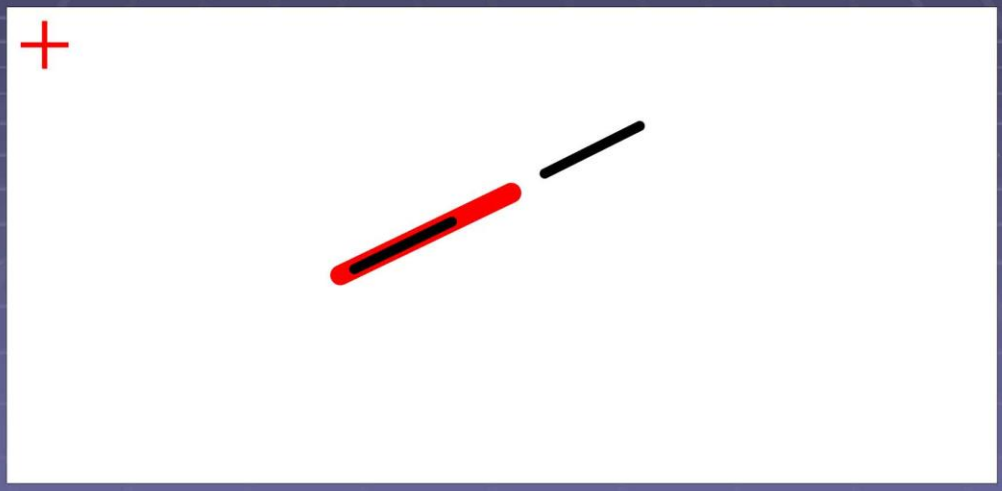
non-maximal shape operations

example with (colinear) non-maximal lines, union



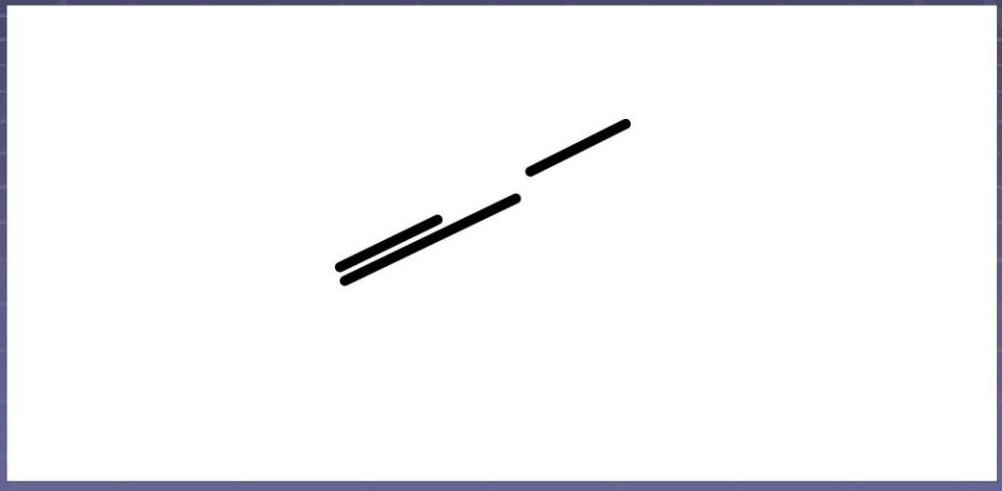
non-maximal shape operations

example with (colinear) non-maximal lines, union



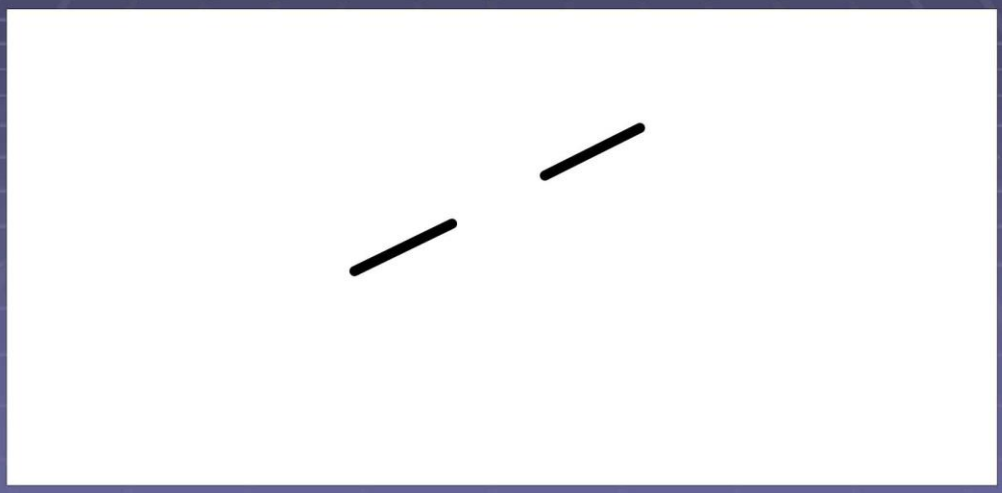
non-maximal shape operations

example with (colinear) non-maximal lines, union



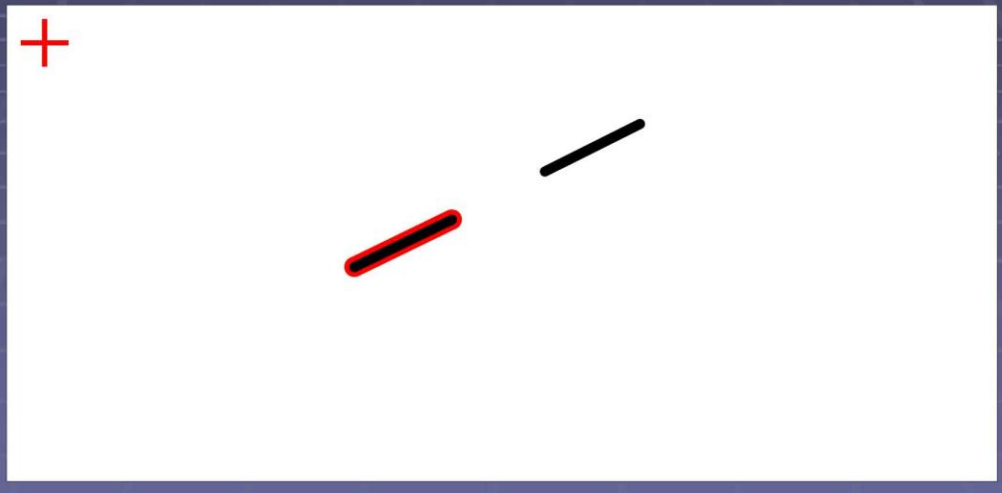
non-maximal shape operations

example with (colinear) non-maximal lines, union



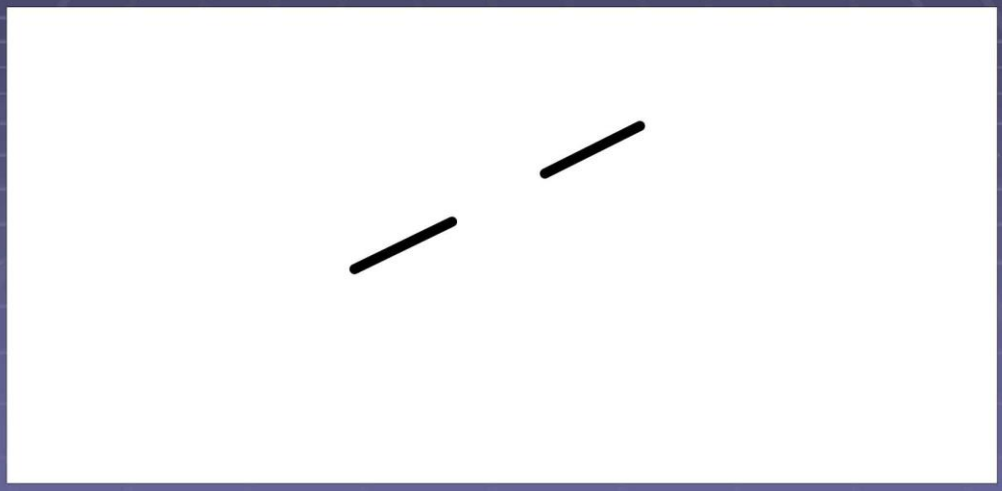
non-maximal shape operations

example with (colinear) non-maximal lines, union



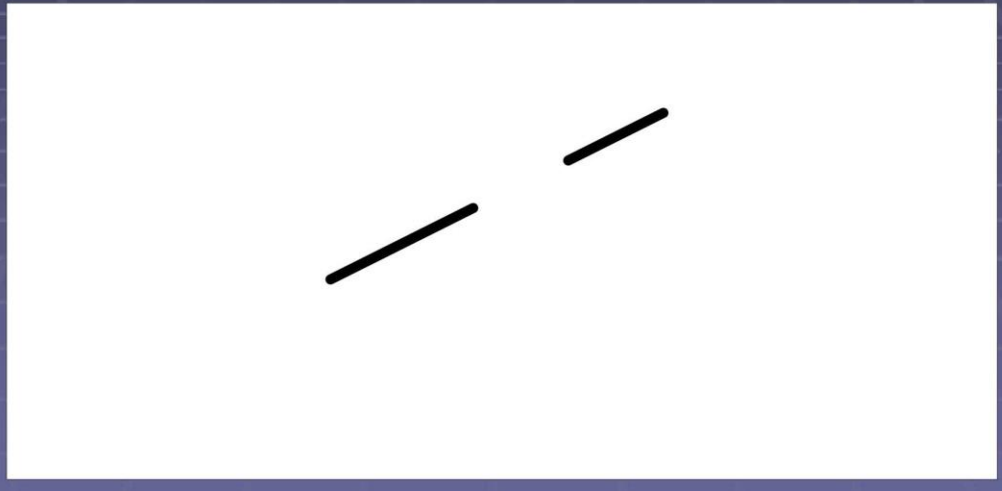
non-maximal shape operations

example with (colinear) non-maximal lines, union



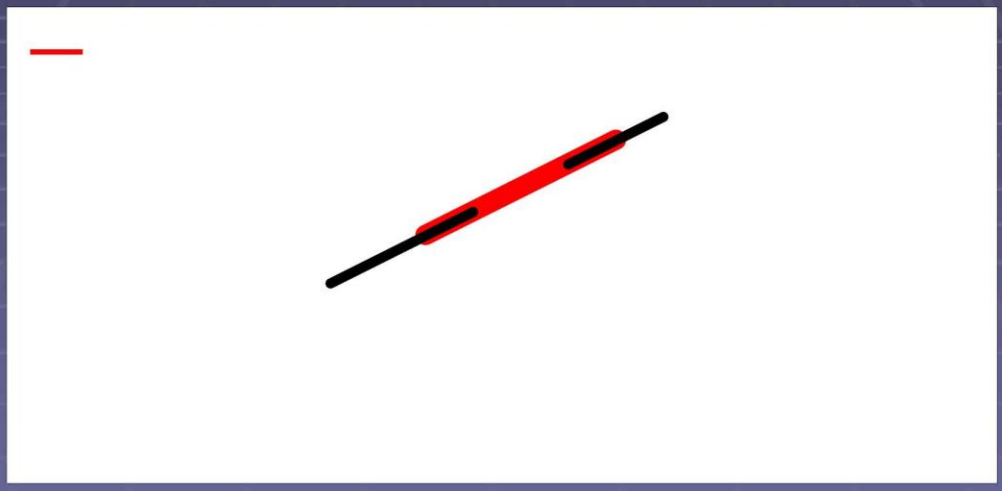
non-maximal shape operations

example with (colinear) non-maximal lines, difference



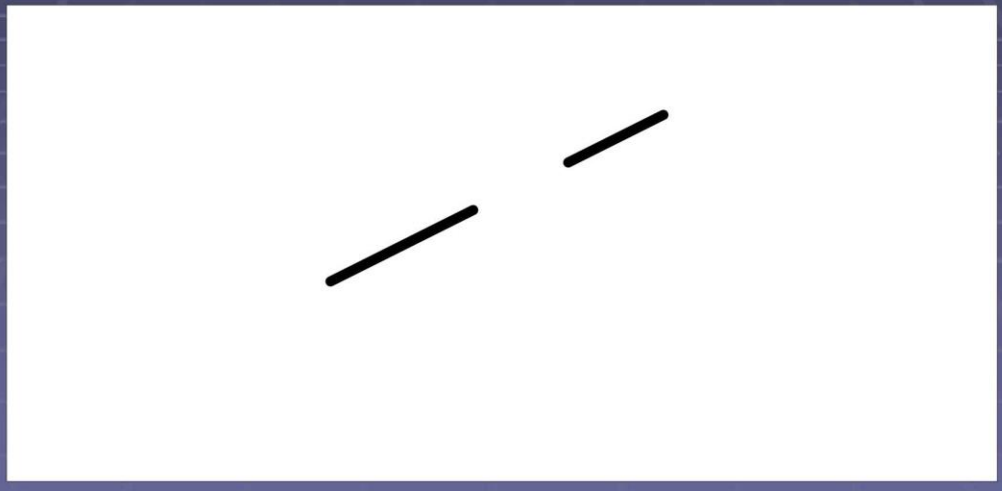
non-maximal shape operations

example with (colinear) non-maximal lines, difference



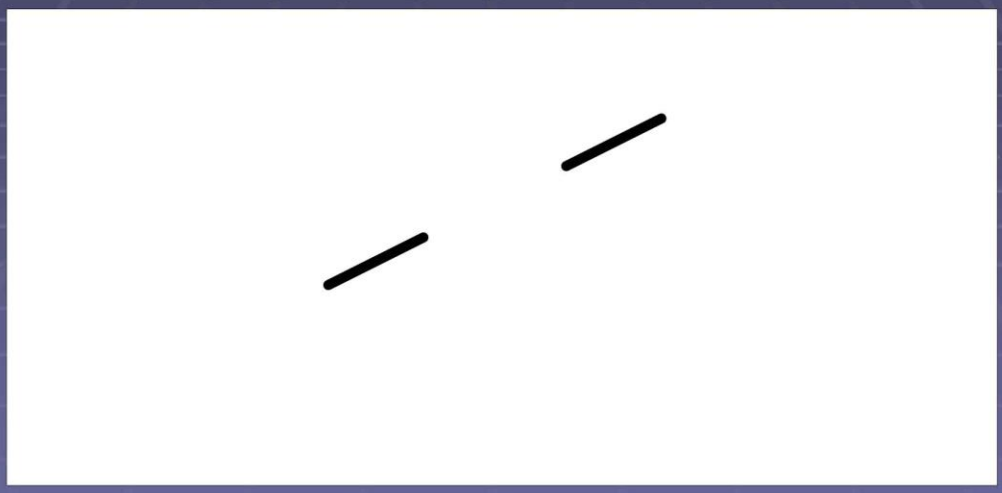
non-maximal shape operations

example with (colinear) non-maximal lines, difference



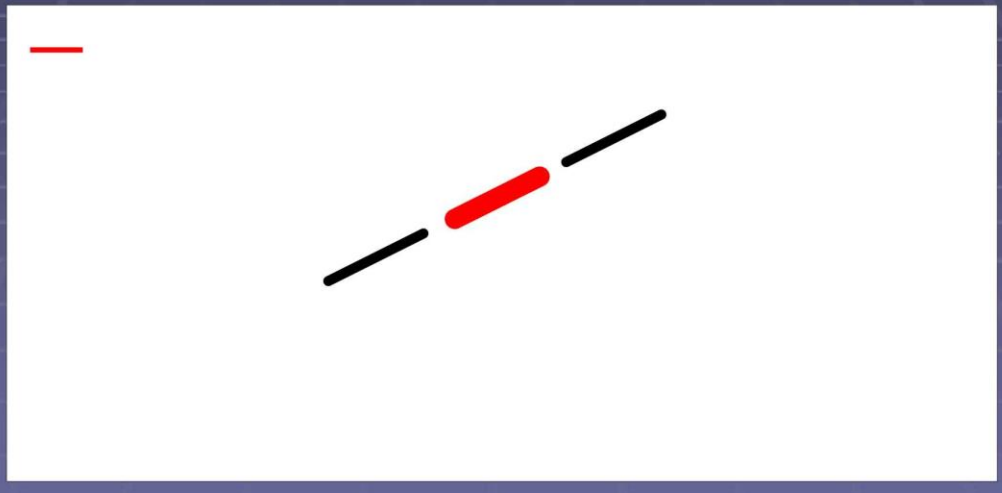
non-maximal shape operations

example with (colinear) non-maximal lines, difference



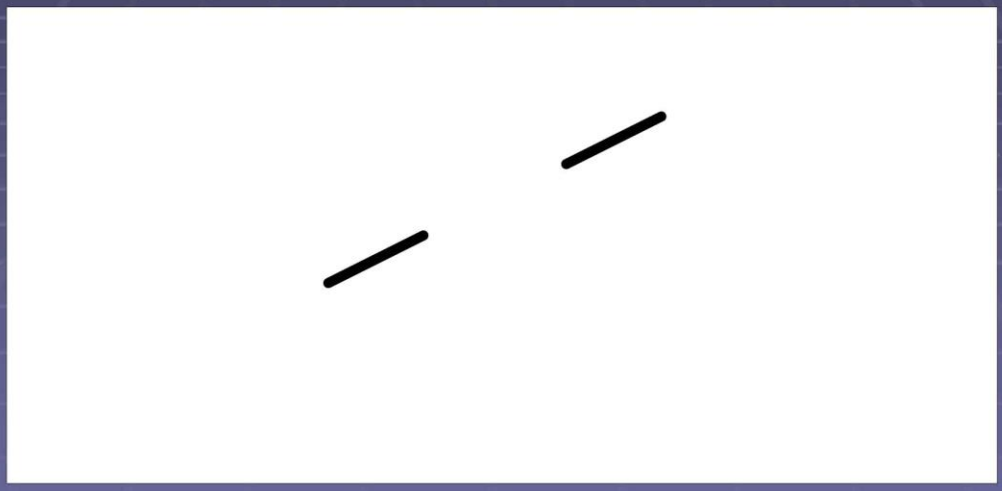
non-maximal shape operations

example with (colinear) non-maximal lines, difference



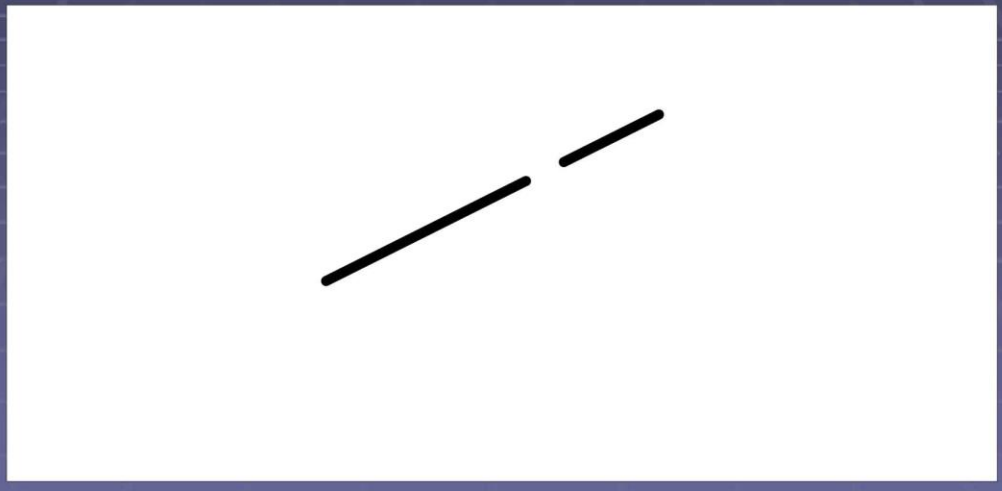
non-maximal shape operations

example with (colinear) non-maximal lines, difference



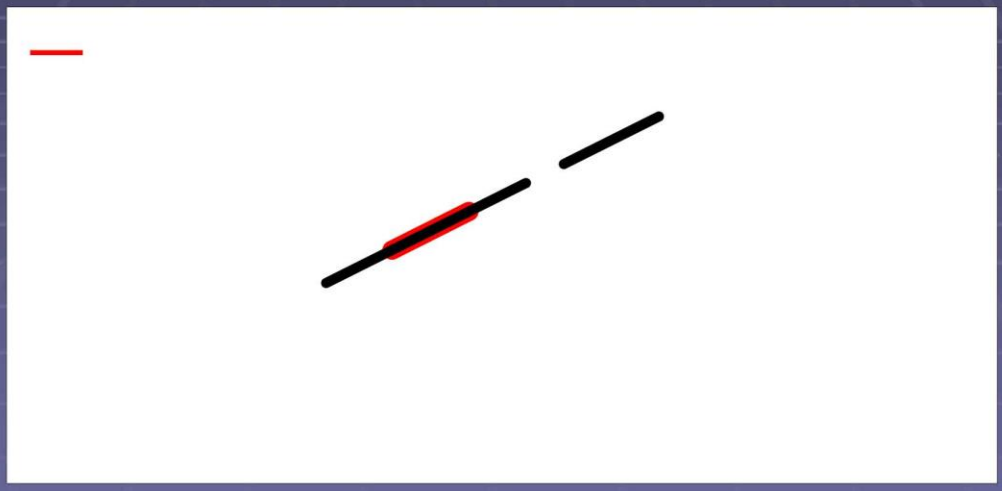
non-maximal shape operations

example with (colinear) non-maximal lines, difference



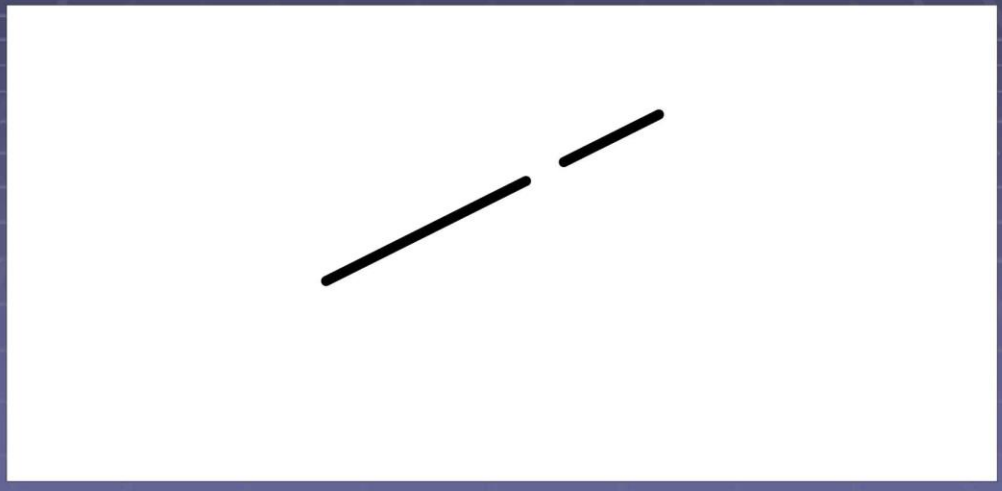
non-maximal shape operations

example with (colinear) non-maximal lines, difference



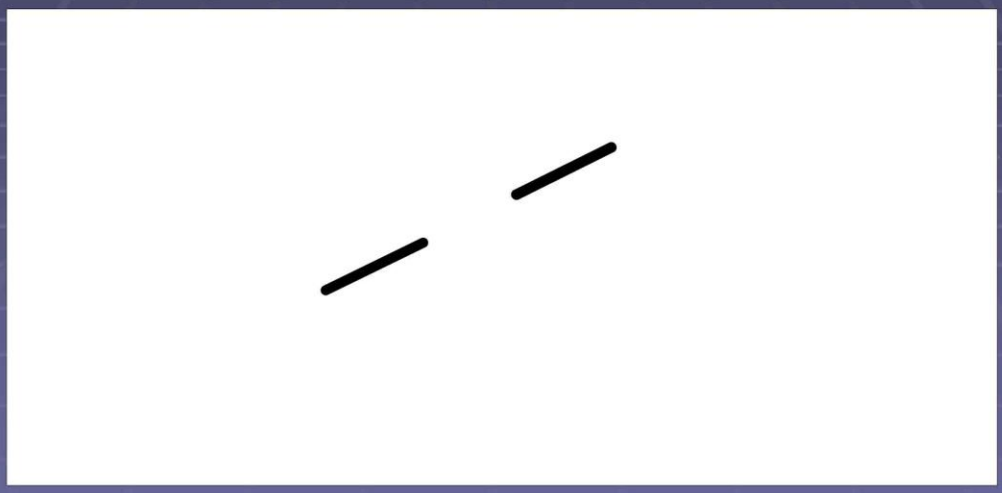
non-maximal shape operations

example with (colinear) non-maximal lines, difference



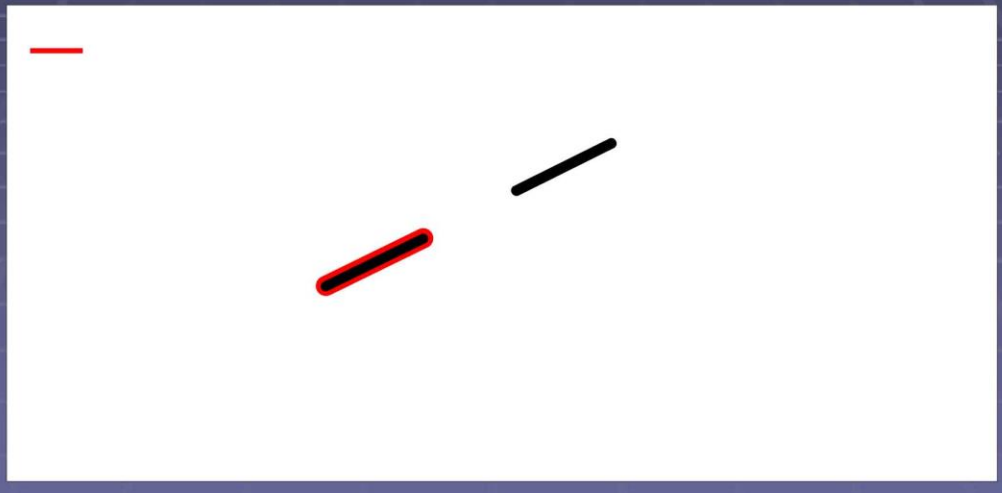
non-maximal shape operations

example with (colinear) non-maximal lines, difference



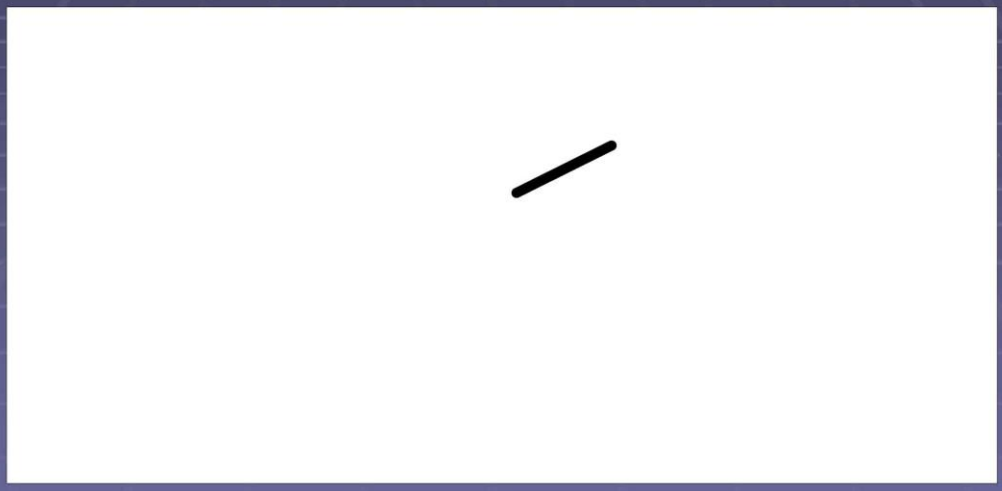
non-maximal shape operations

example with (colinear) non-maximal lines, difference



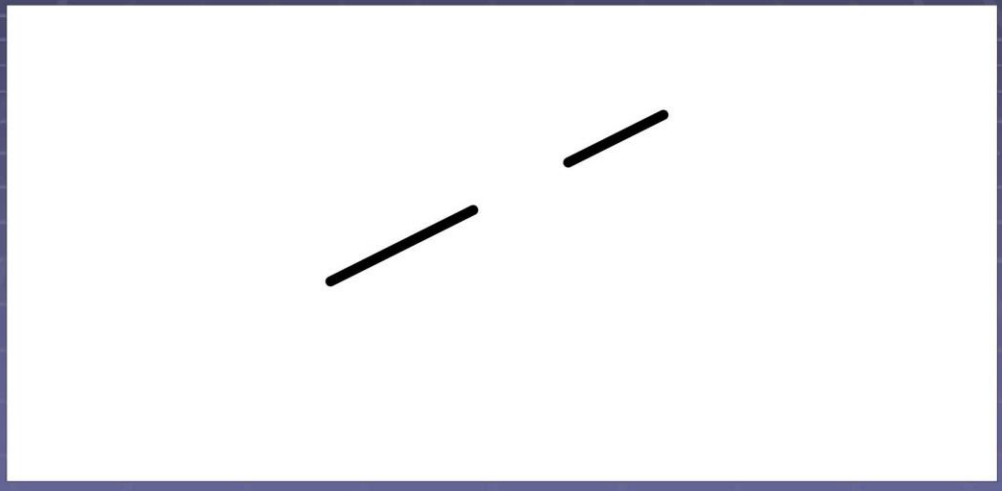
non-maximal shape operations

example with (colinear) non-maximal lines, difference



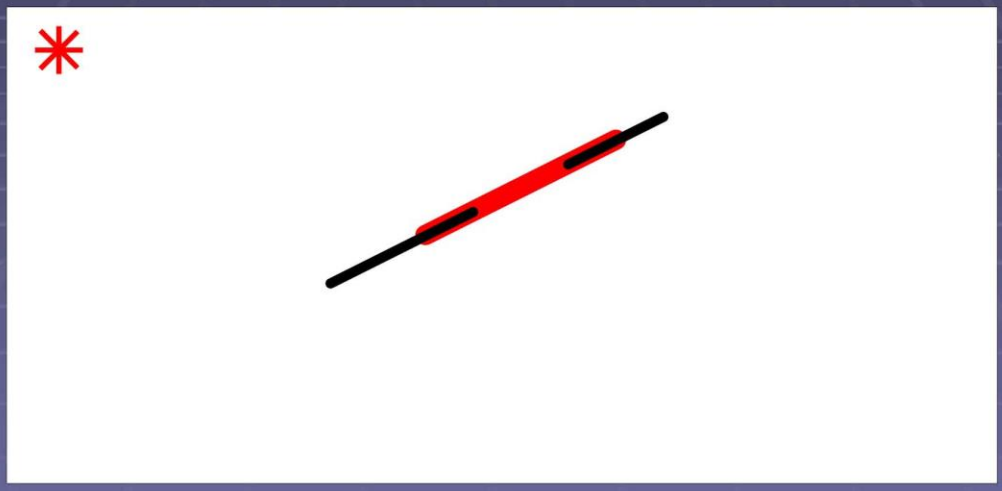
non-maximal shape operations

example with (colinear) non-maximal lines, intersection



non-maximal shape operations

example with (colinear) non-maximal lines, intersection

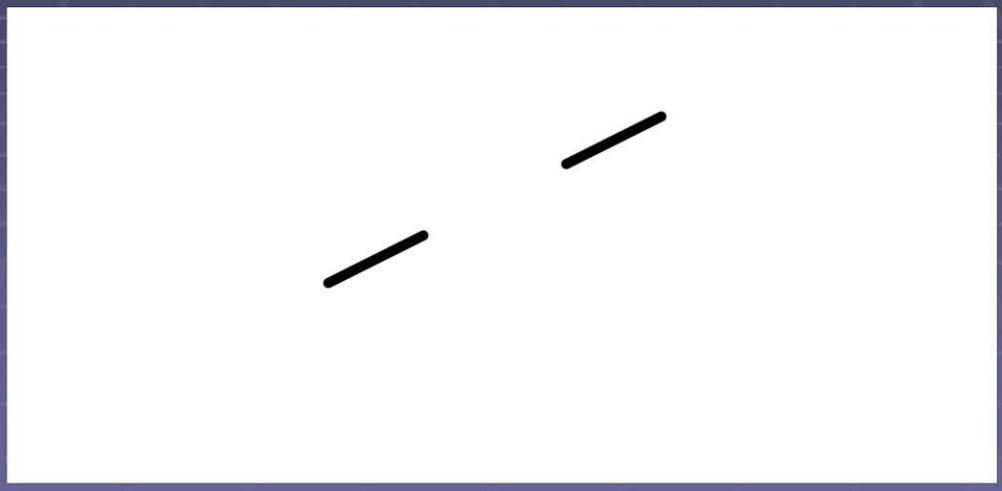


non-maximal shape operations

example with (colinear) non-maximal lines, intersection

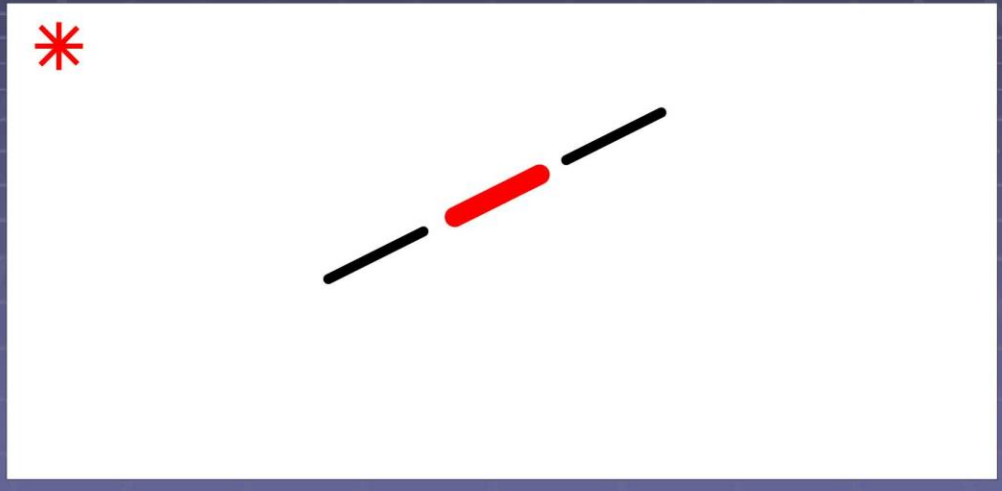
non-maximal shape operations

example with (colinear) non-maximal lines, intersection



non-maximal shape operations

example with (colinear) non-maximal lines, intersection

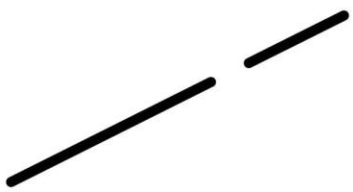


non-maximal shape operations

example with (colinear) non-maximal lines, intersection

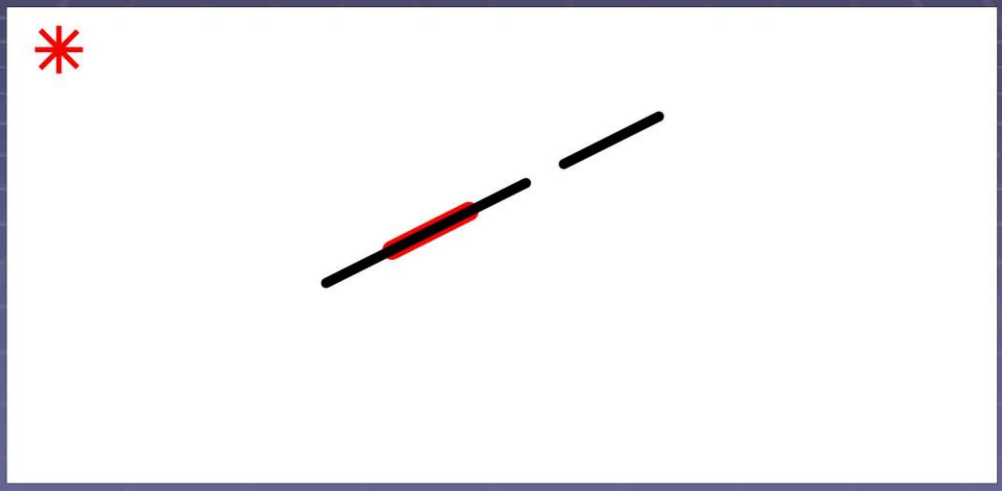
non-maximal shape operations

example with (colinear) non-maximal lines, intersection



non-maximal shape operations

example with (colinear) non-maximal lines, intersection

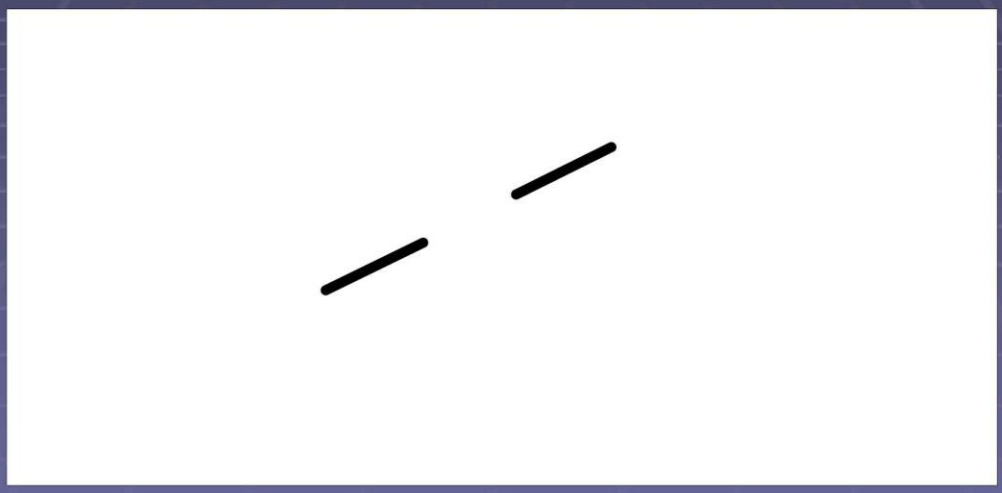


non-maximal shape operations

example with (colinear) non-maximal lines, intersection

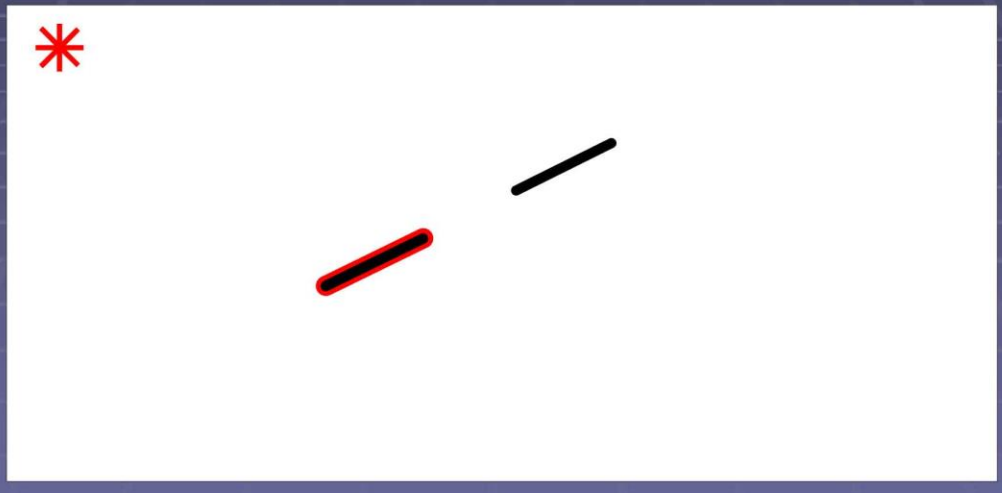
non-maximal shape operations

example with (colinear) non-maximal lines, intersection



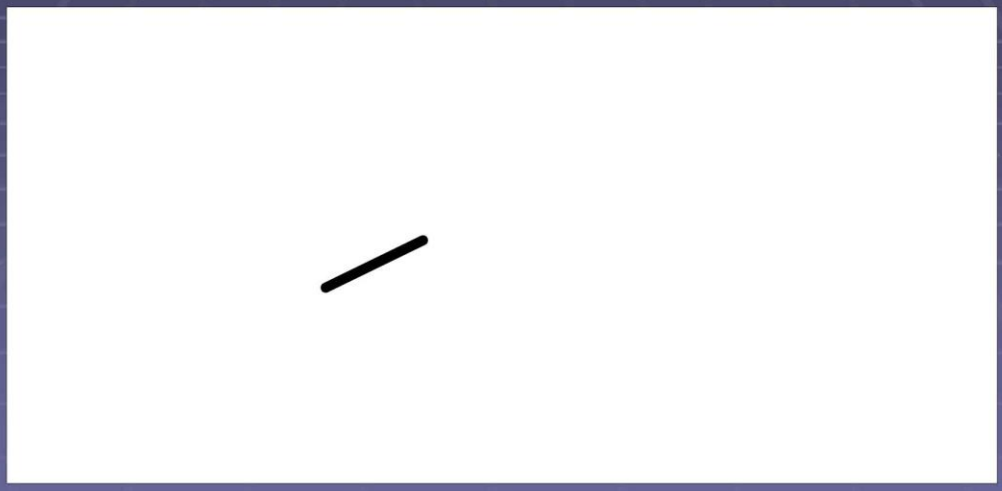
non-maximal shape operations

example with (colinear) non-maximal lines, intersection



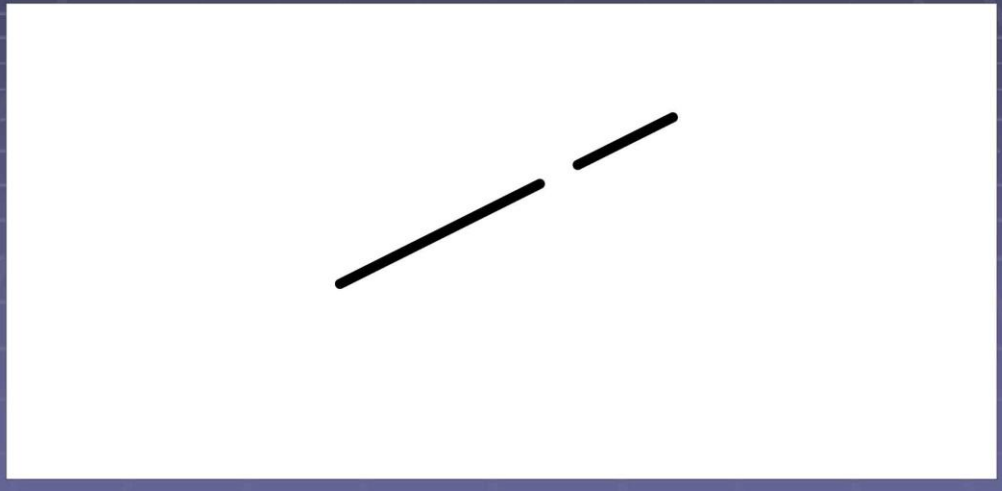
non-maximal shape operations

example with (colinear) non-maximal lines, intersection



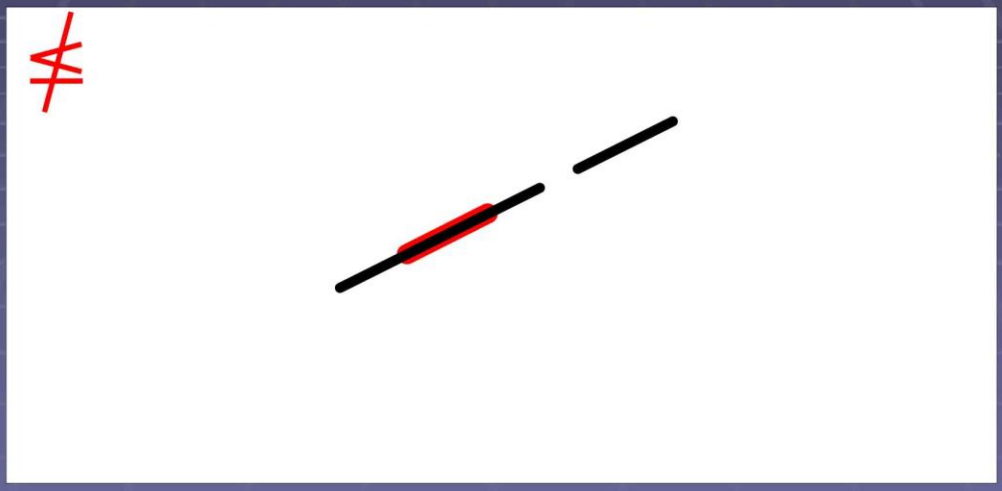
non-maximal shape operations

example with (colinear) non-maximal lines, sub-shape



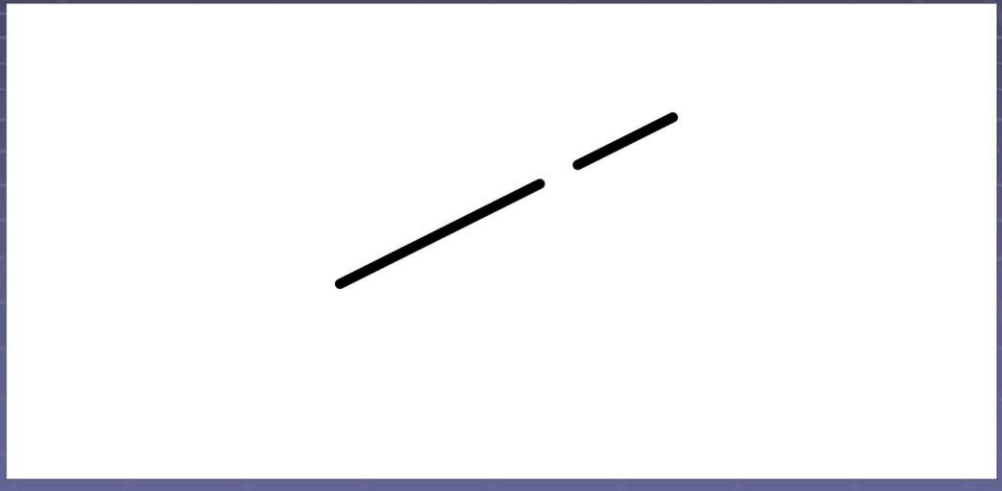
non-maximal shape operations

example with (colinear) non-maximal lines, sub-shape



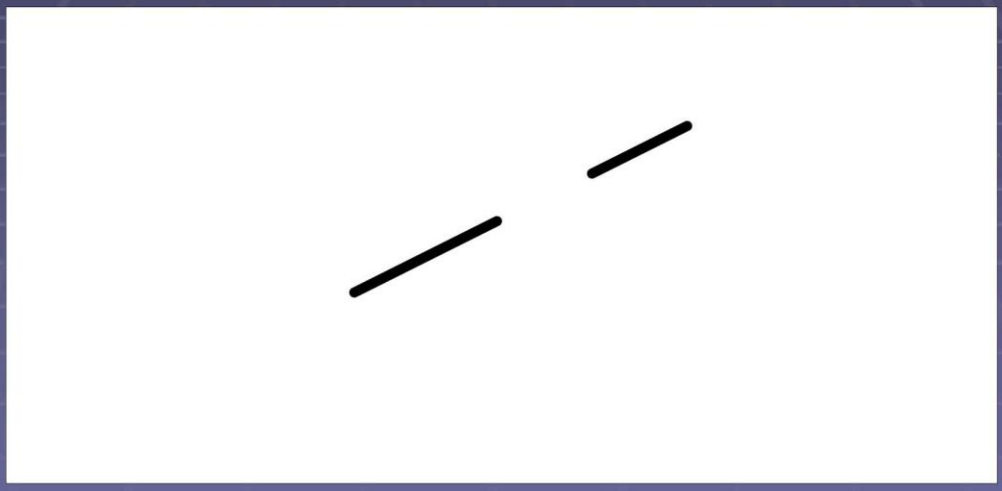
non-maximal shape operations

example with (colinear) non-maximal lines, sub-shape



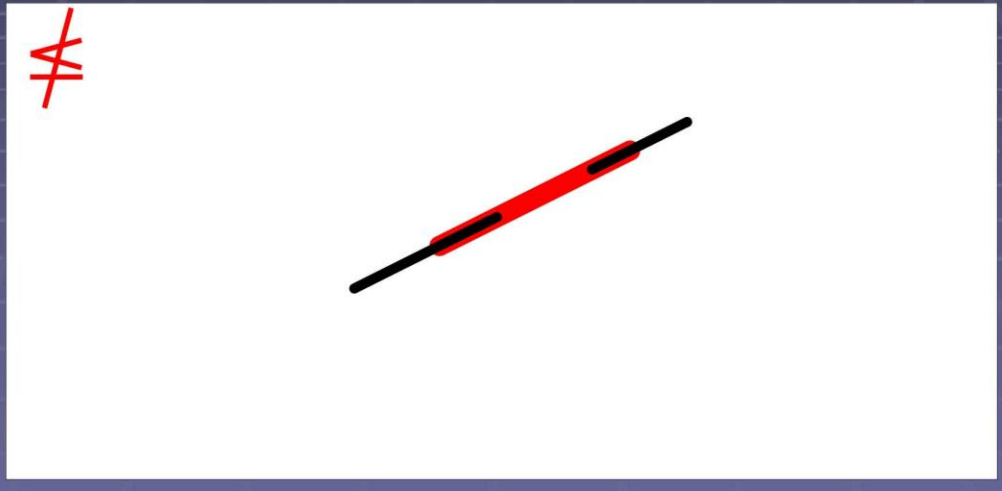
non-maximal shape operations

example with (colinear) non-maximal lines, sub-shape



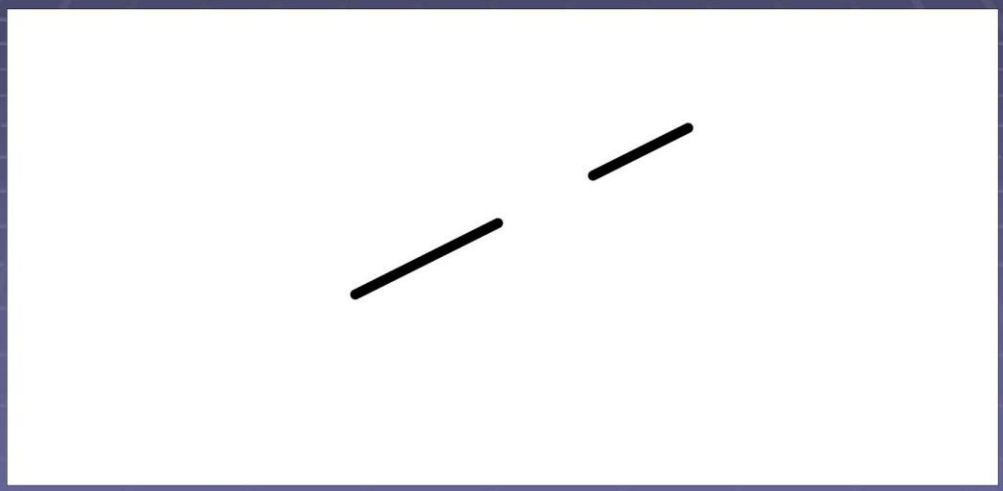
non-maximal shape operations

example with (colinear) non-maximal lines, sub-shape



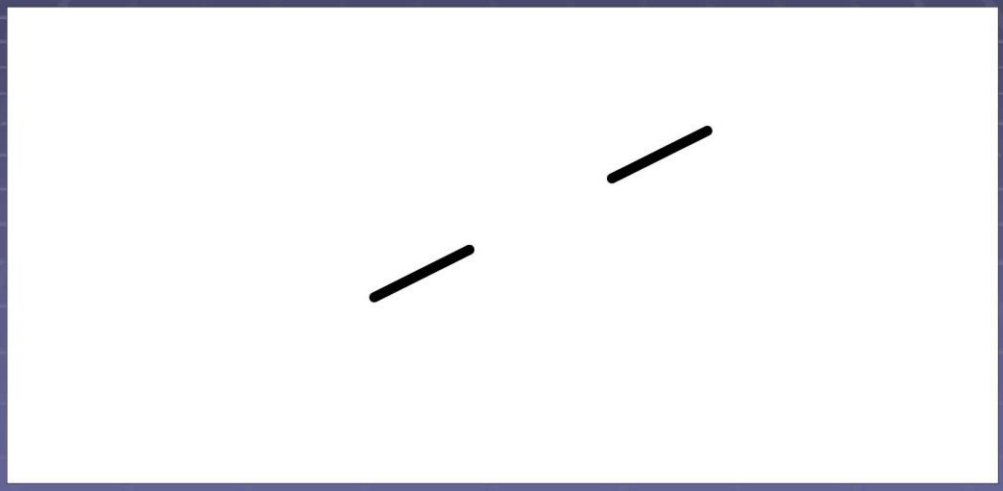
non-maximal shape operations

example with (colinear) non-maximal lines, sub-shape



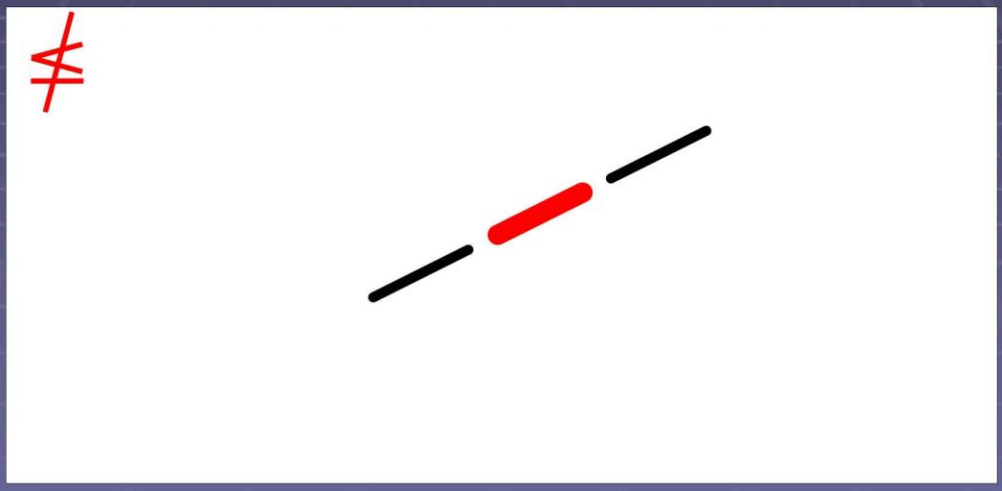
non-maximal shape operations

example with (colinear) non-maximal lines, sub-shape



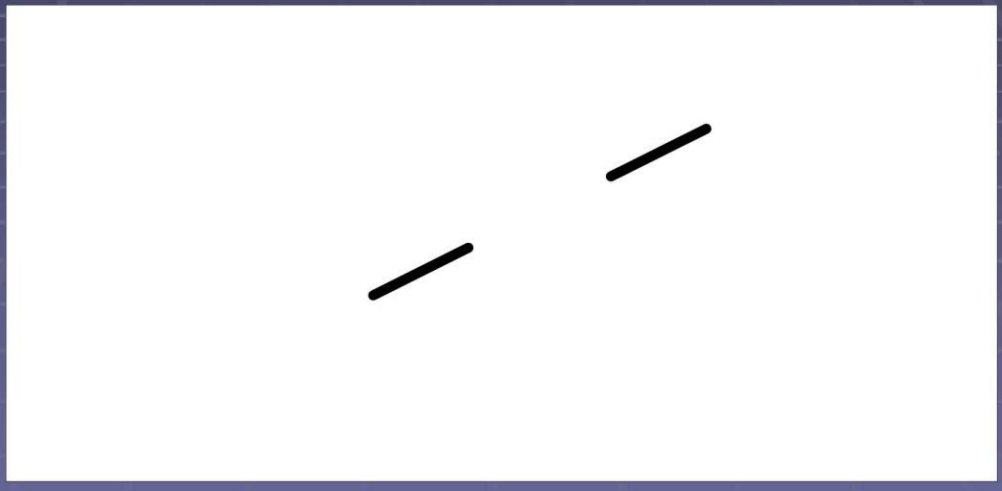
non-maximal shape operations

example with (colinear) non-maximal lines, sub-shape



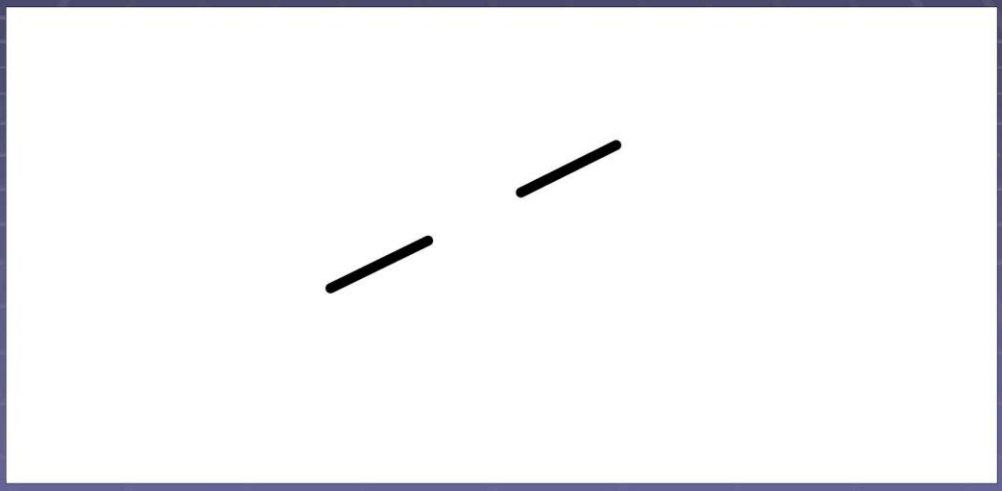
non-maximal shape operations

example with (colinear) non-maximal lines, sub-shape



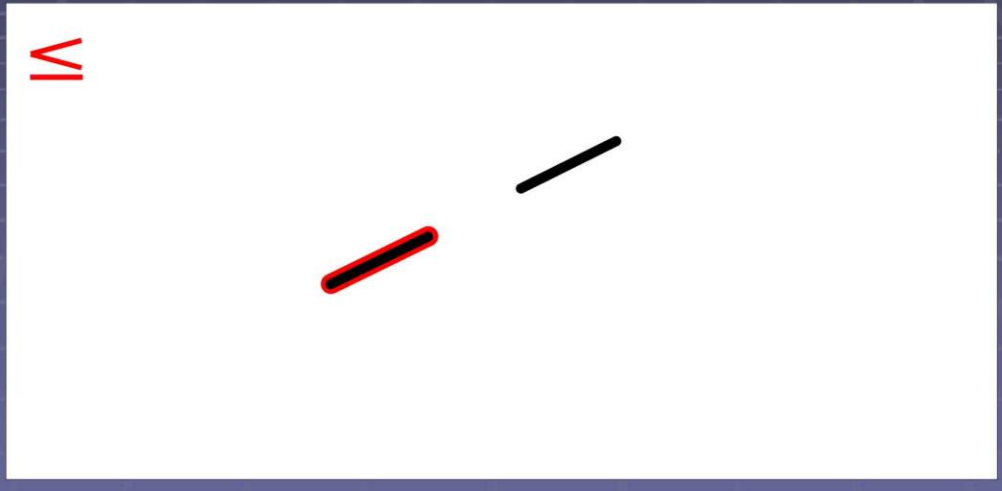
non-maximal shape operations

example with (colinear) non-maximal lines, sub-shape



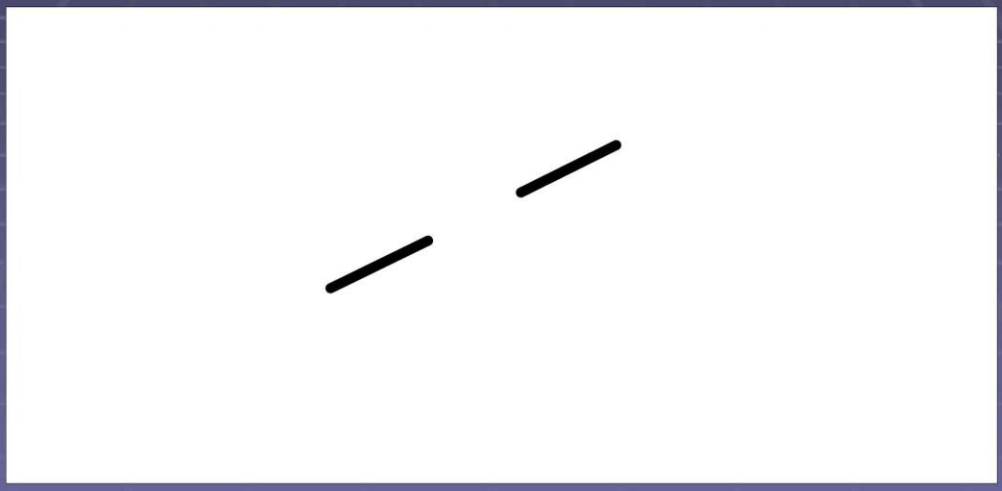
non-maximal shape operations

example with (colinear) non-maximal lines, sub-shape



non-maximal shape operations

example with (colinear) non-maximal lines, sub-shape

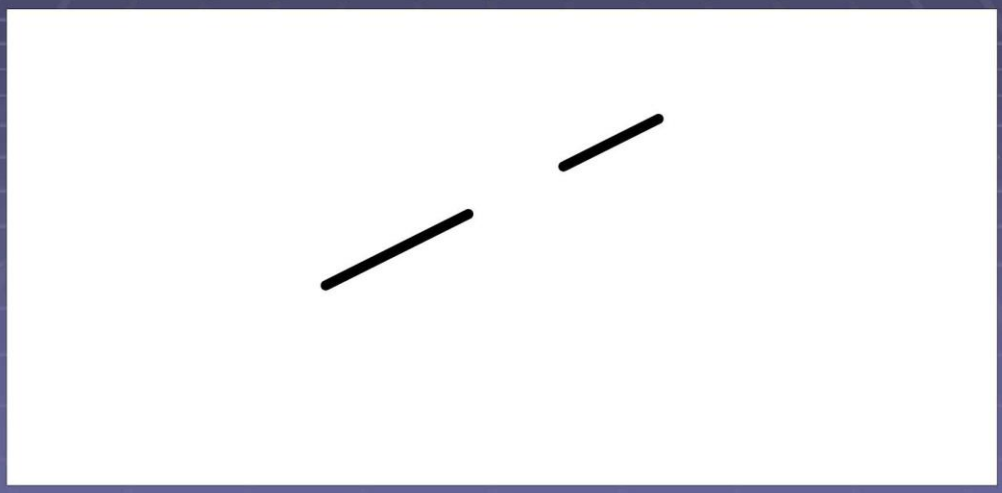


maximal shape algebras U_{12}

- maximal shape operations
  + (union, sum)
  - (difference, subtraction)
  * (intersection, multiplication)
  ≤ (sub-shape, inclusion)
- shapes are sets of maximal lines
- high potential for shape emergence
- examples with shapes with co-linear lines

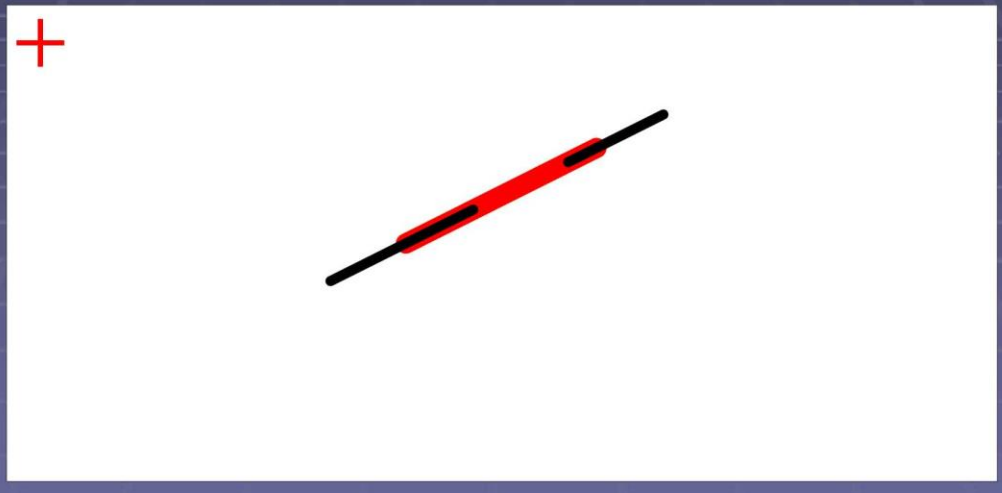
maximal shape operations

example with (colinear) maximal lines, union



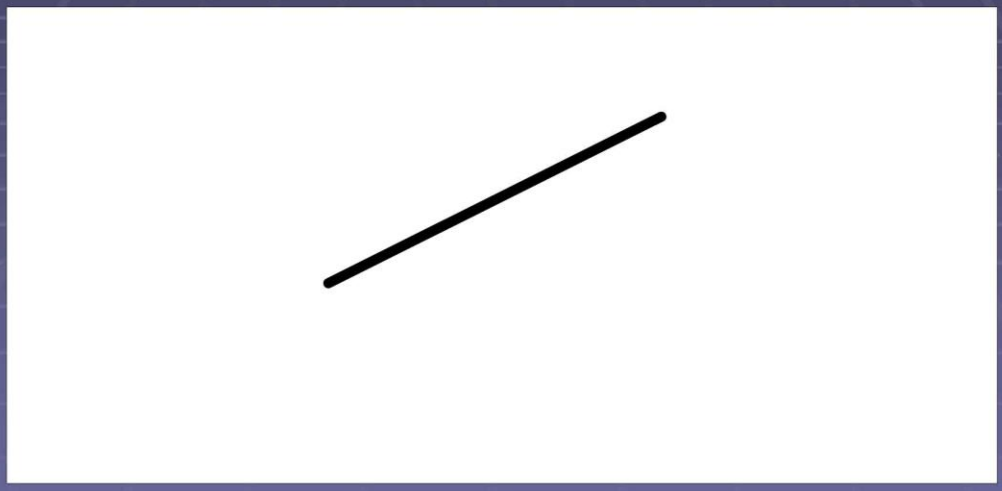
maximal shape operations

example with (colinear) maximal lines, union



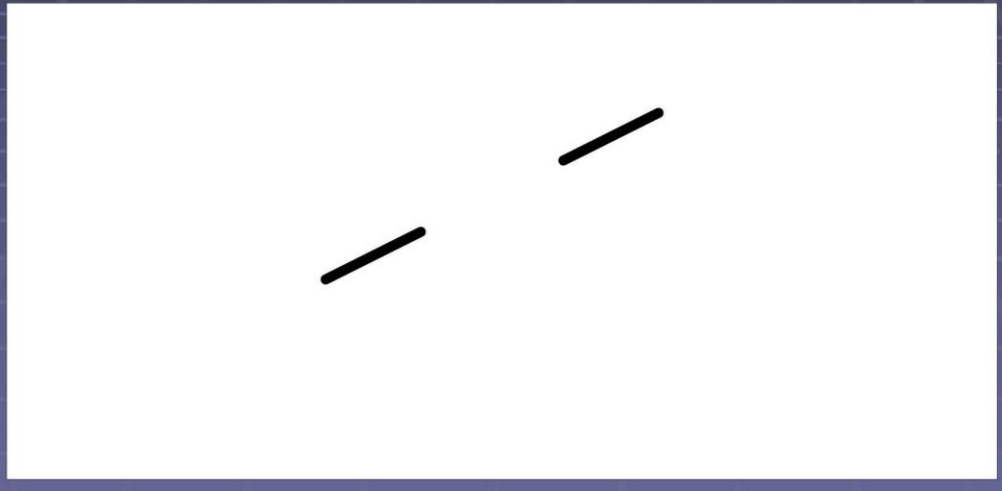
maximal shape operations

example with (colinear) maximal lines, union



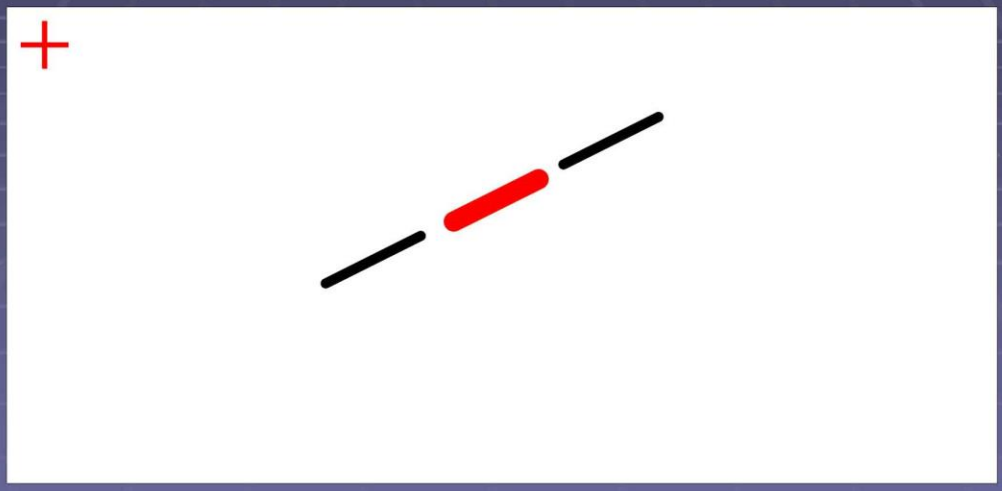
maximal shape operations

example with (colinear) maximal lines, union



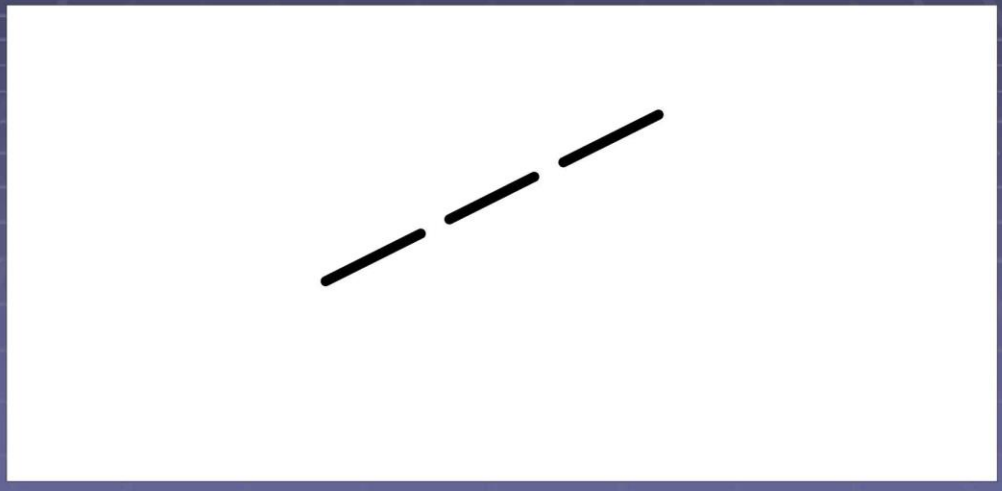
maximal shape operations

example with (colinear) maximal lines, union



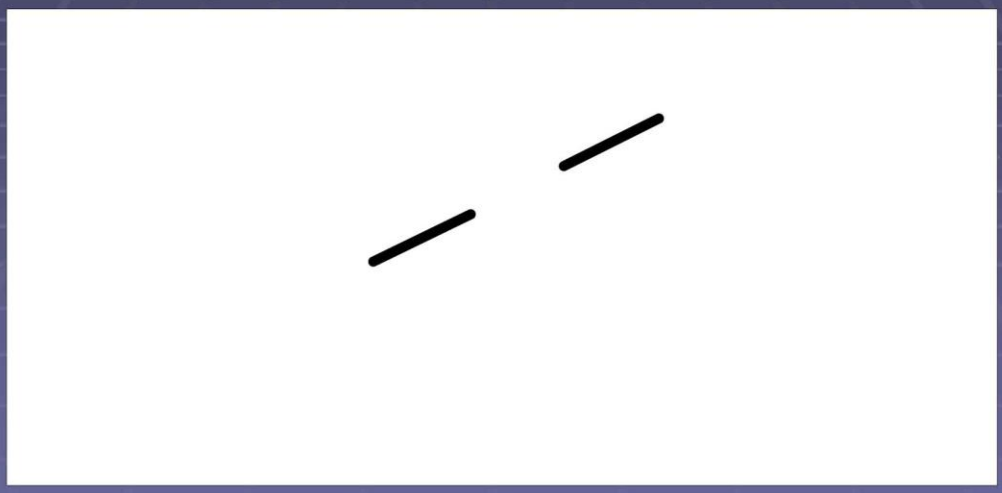
maximal shape operations

example with (colinear) maximal lines, union



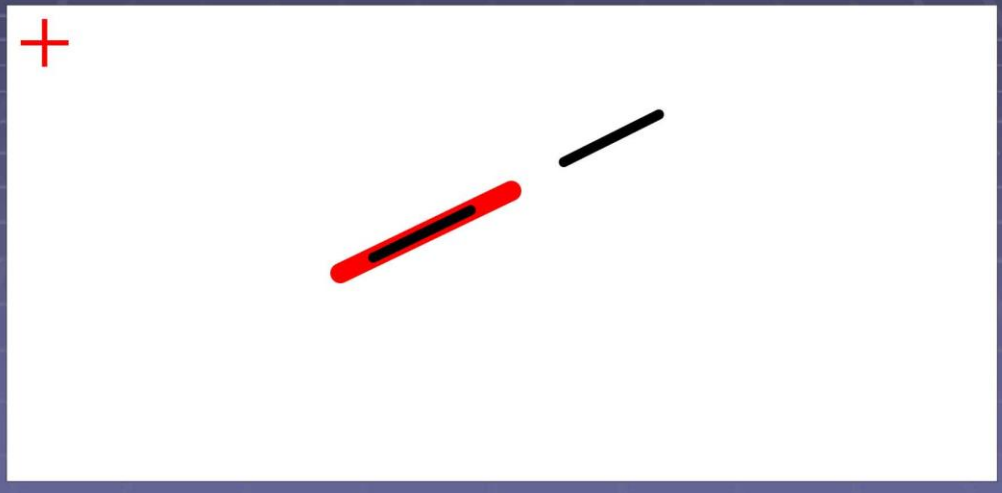
maximal shape operations

example with (colinear) maximal lines, union



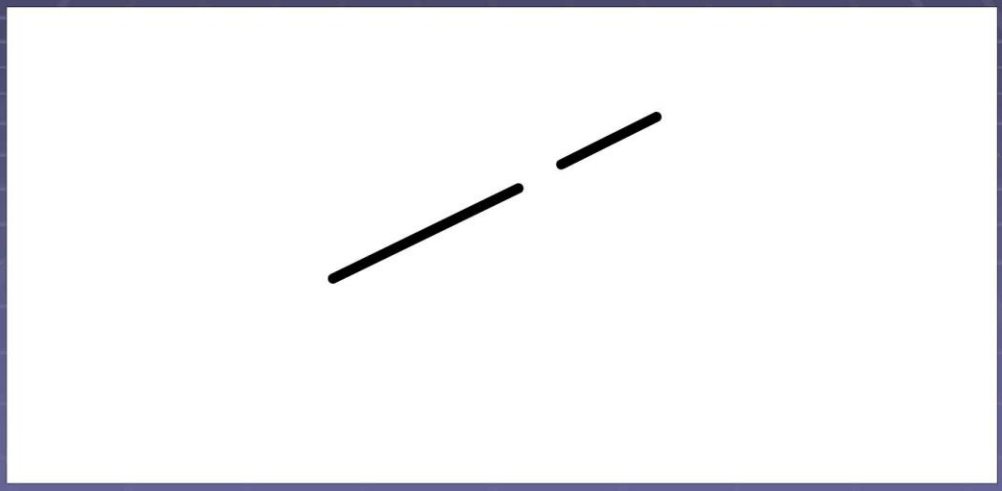
maximal shape operations

example with (colinear) maximal lines, union



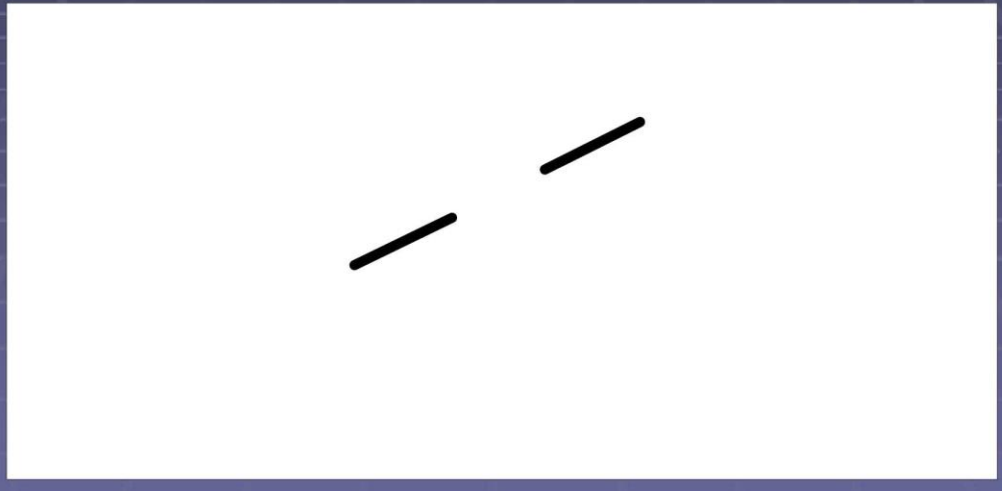
maximal shape operations

example with (colinear) maximal lines, union



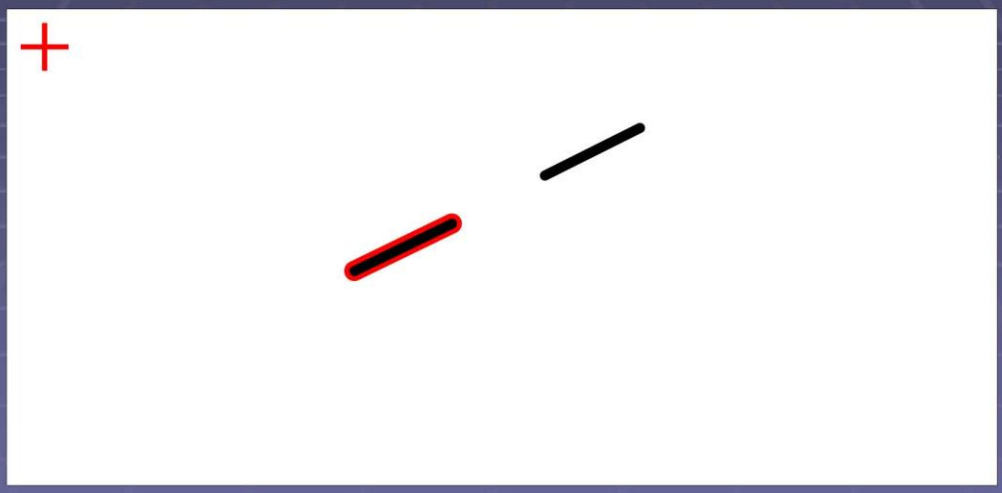
maximal shape operations

example with (colinear) maximal lines, union



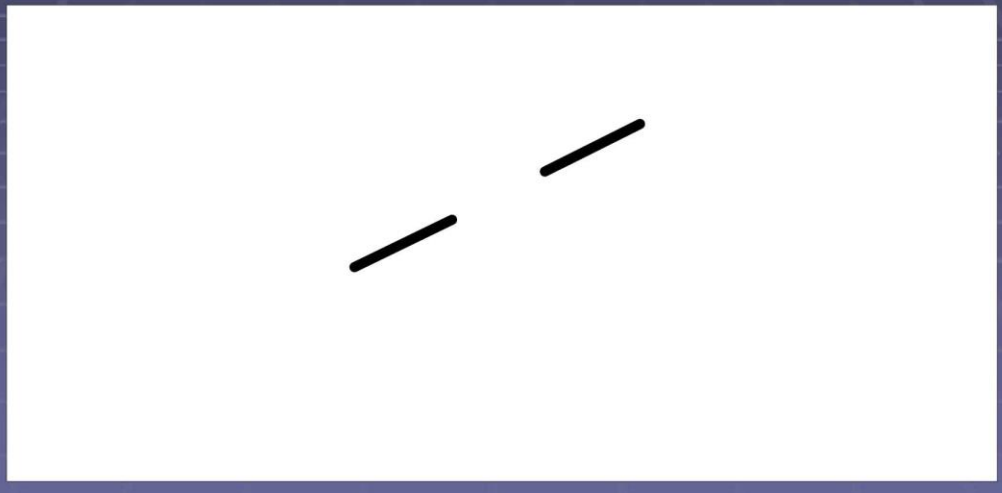
maximal shape operations

example with (colinear) maximal lines, union



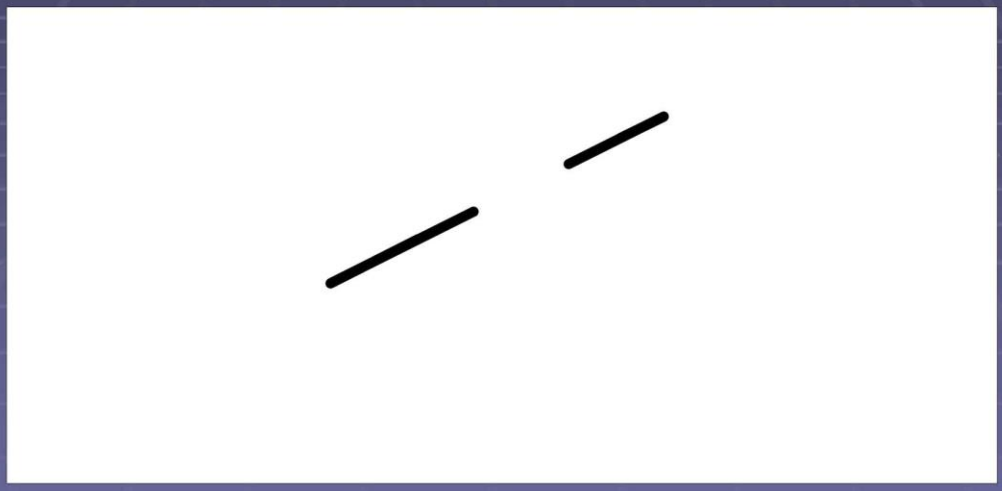
maximal shape operations

example with (colinear) maximal lines, union



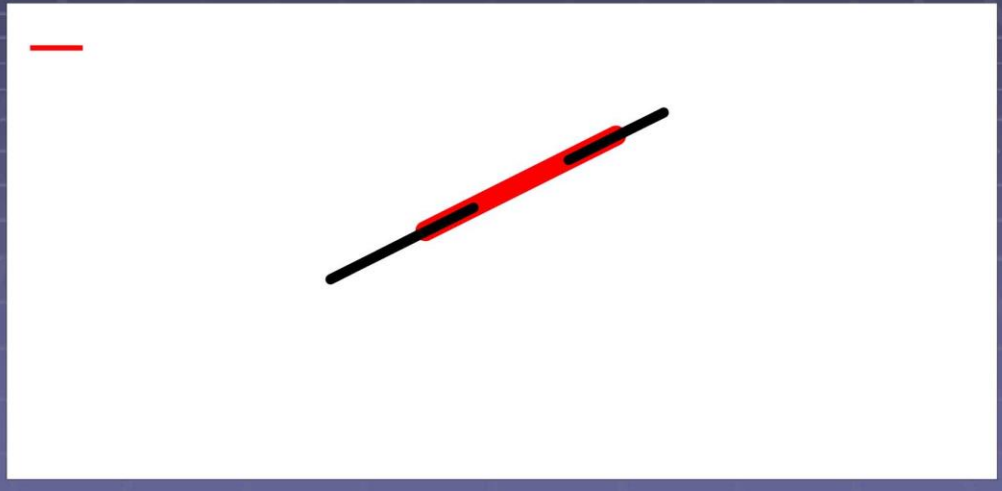
maximal shape operations

example with (colinear) maximal lines, difference



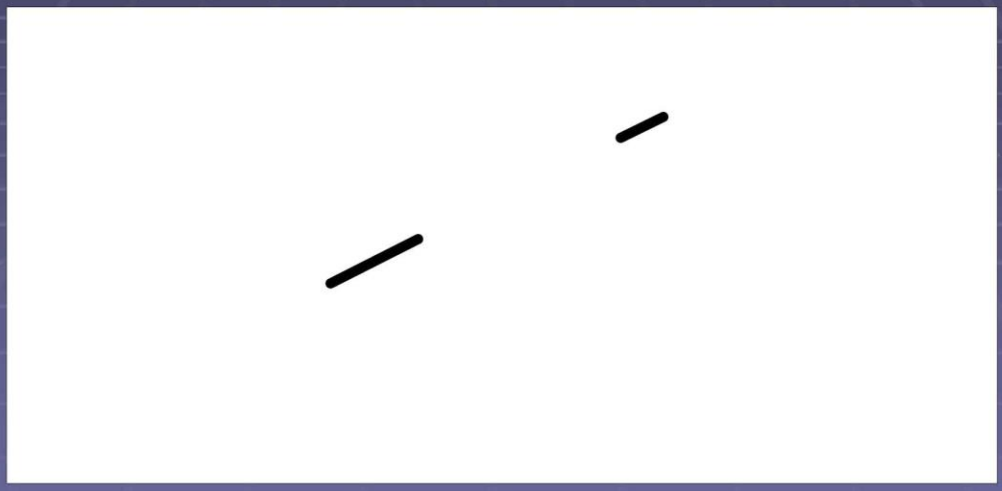
maximal shape operations

example with (colinear) maximal lines, difference



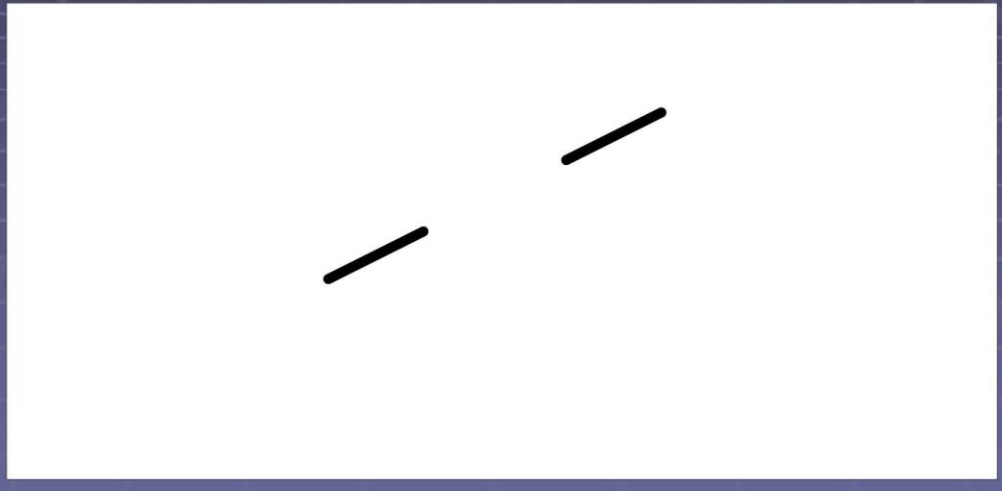
maximal shape operations

example with (colinear) maximal lines, difference



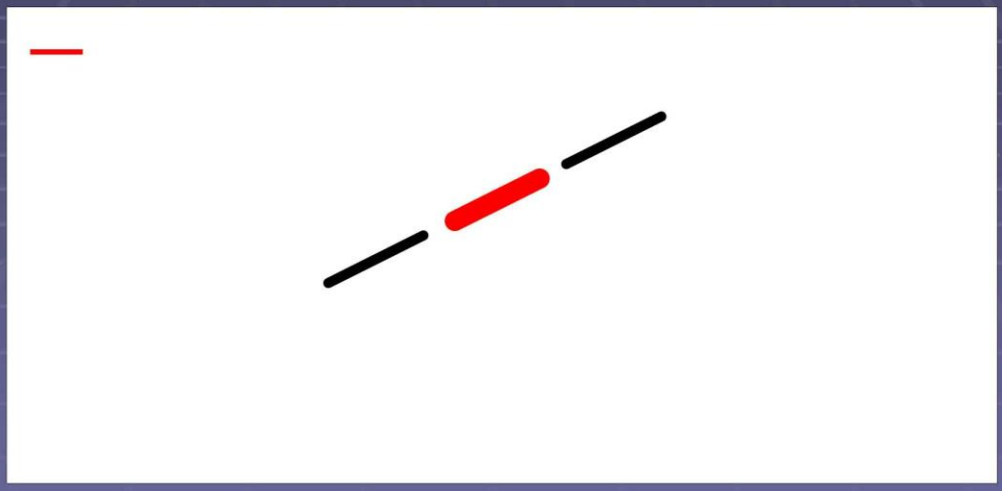
maximal shape operations

example with (colinear) maximal lines, difference



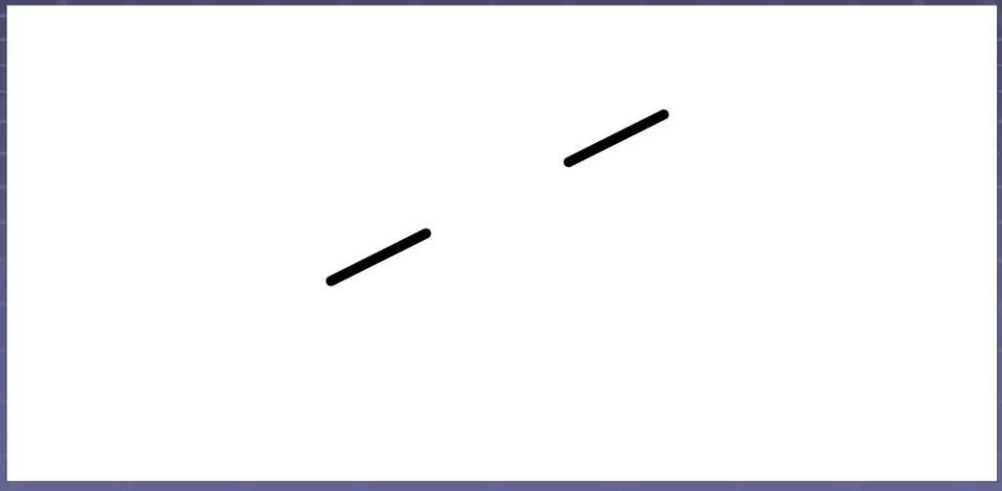
maximal shape operations

example with (colinear) maximal lines, difference



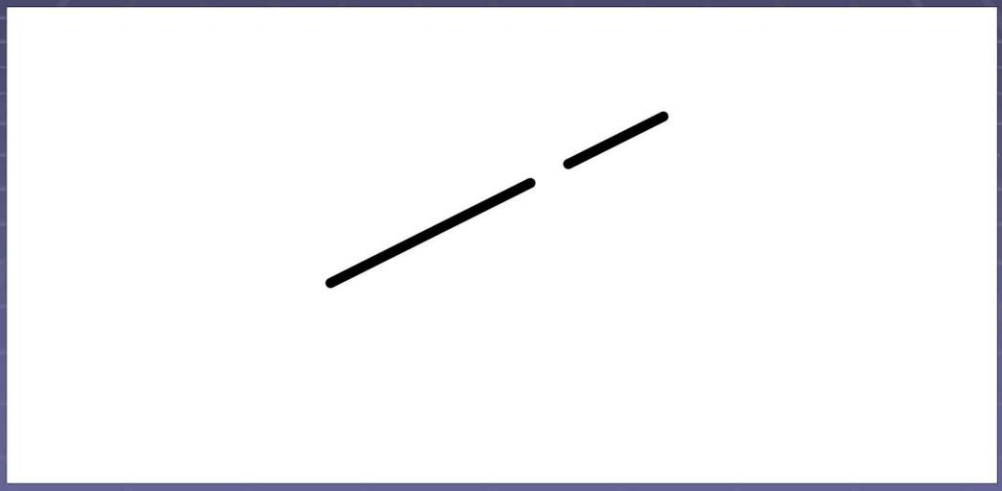
maximal shape operations

example with (colinear) maximal lines, difference



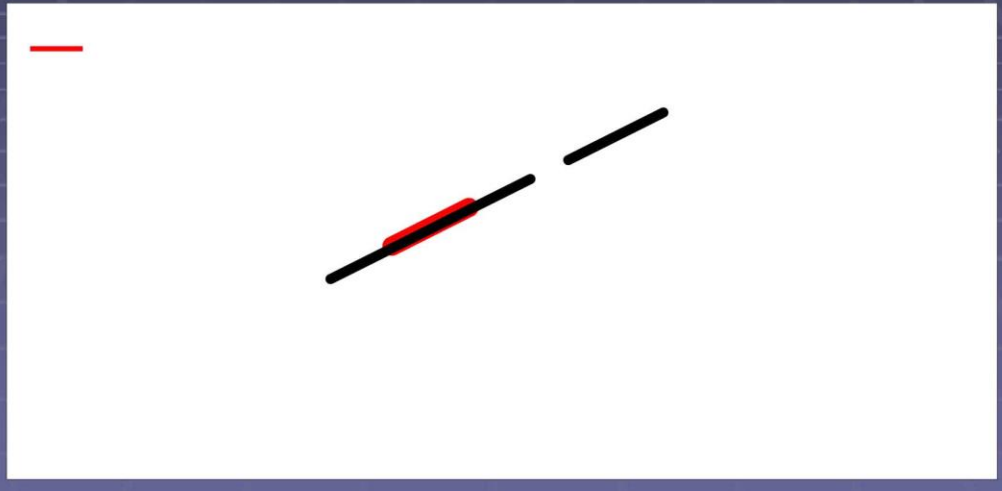
maximal shape operations

example with (colinear) maximal lines, difference



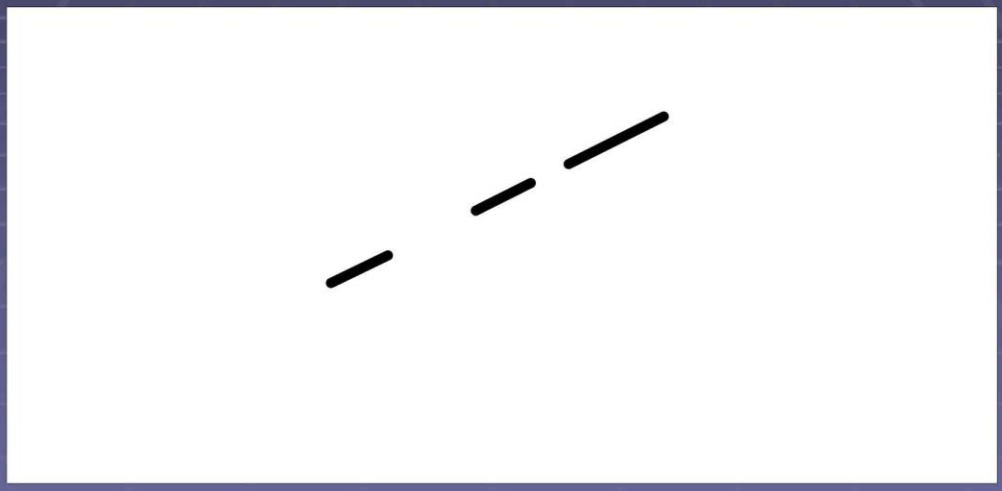
maximal shape operations

example with (colinear) maximal lines, difference



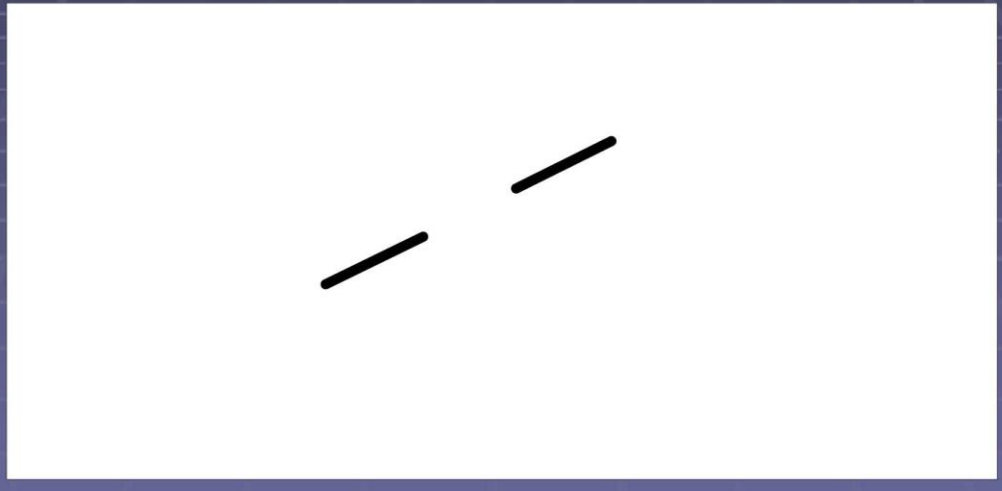
maximal shape operations

example with (colinear) maximal lines, difference



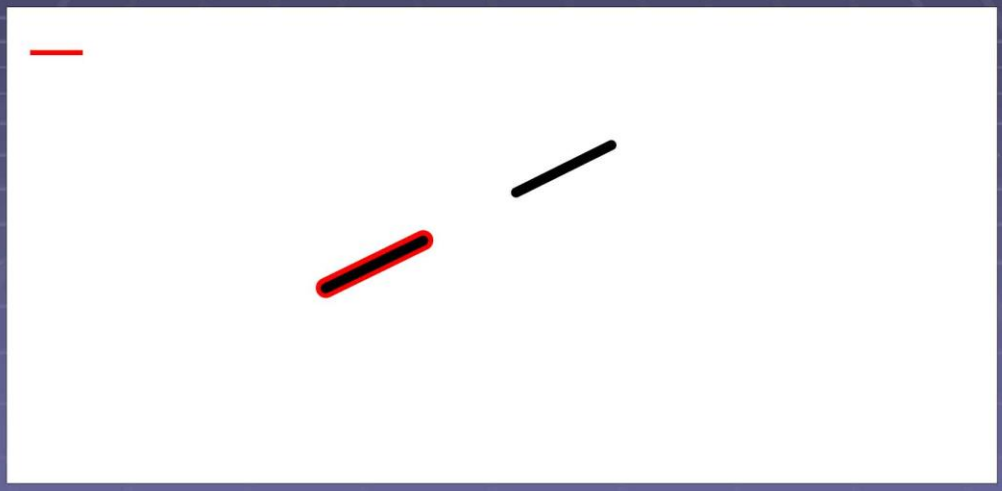
maximal shape operations

example with (colinear) maximal lines, difference



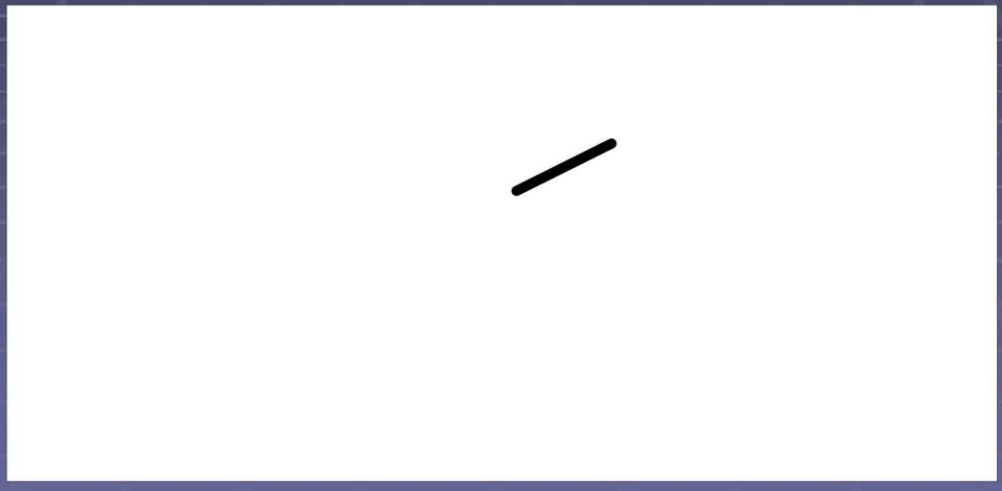
maximal shape operations

example with (colinear) maximal lines, difference



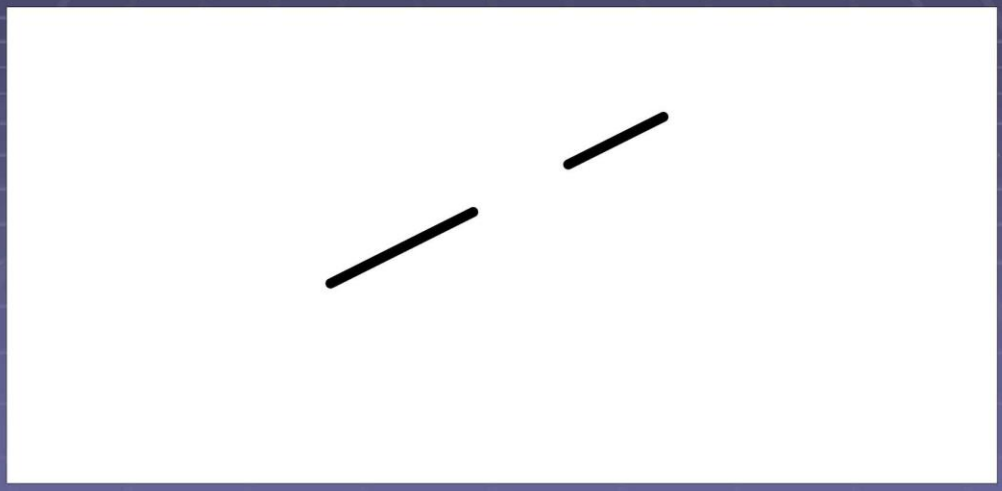
maximal shape operations

example with (colinear) maximal lines, difference



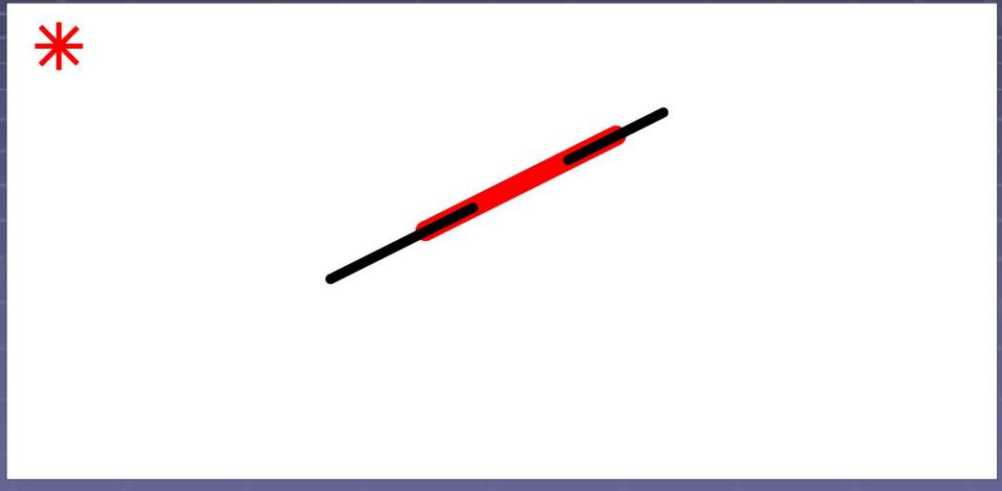
maximal shape operations

example with (colinear) maximal lines, intersection



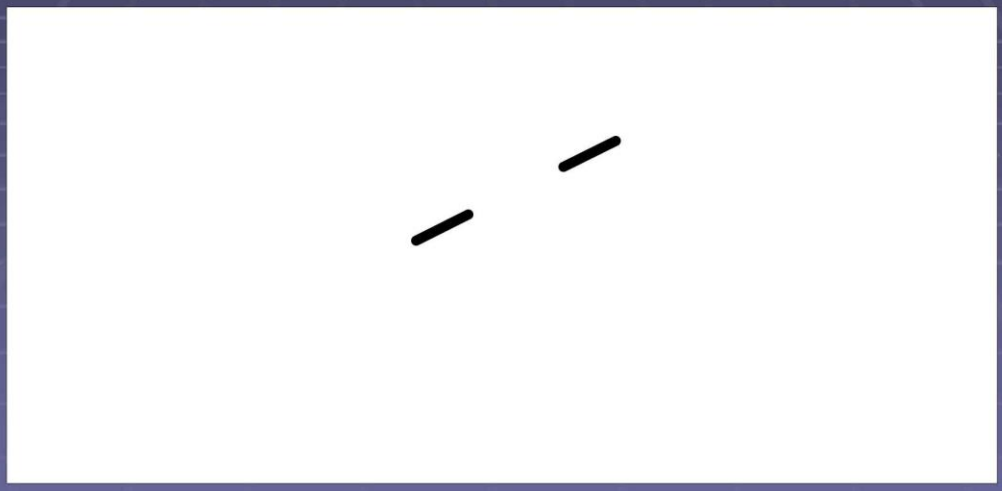
maximal shape operations

example with (colinear) maximal lines, intersection



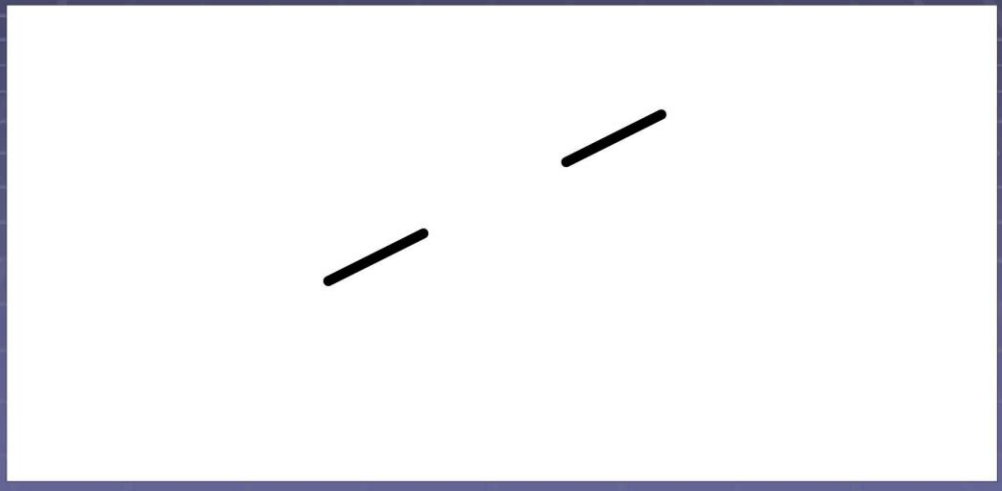
maximal shape operations

example with (colinear) maximal lines, intersection



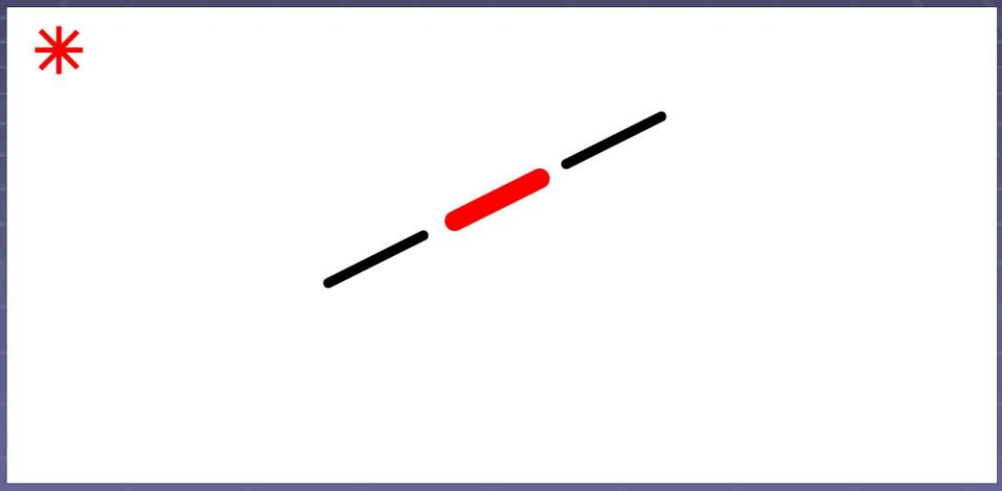
maximal shape operations

example with (colinear) maximal lines, intersection



maximal shape operations

example with (colinear) maximal lines, intersection

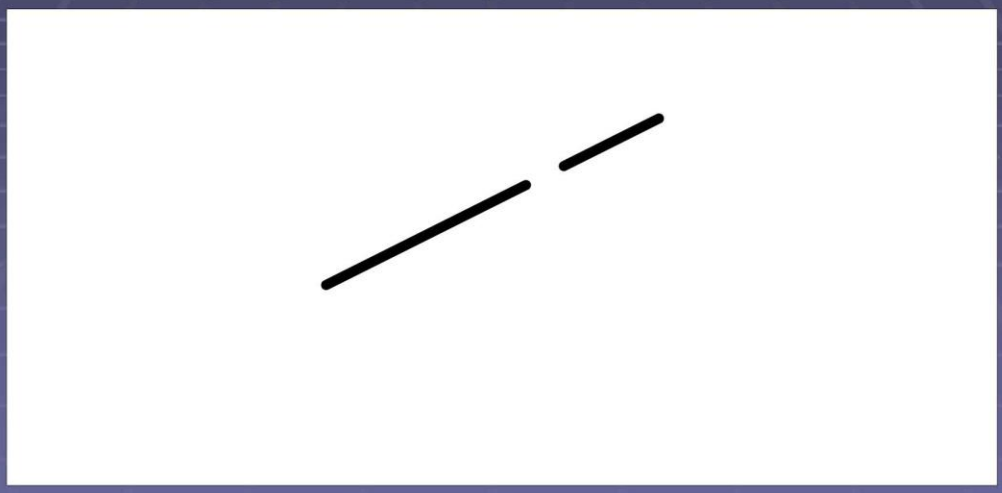


maximal shape operations

example with (colinear) maximal lines, intersection

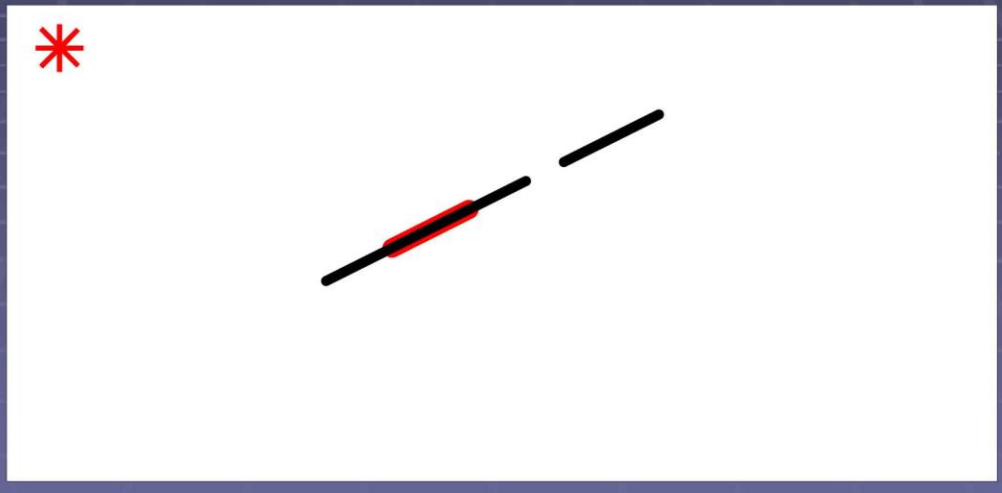
maximal shape operations

example with (colinear) maximal lines, intersection



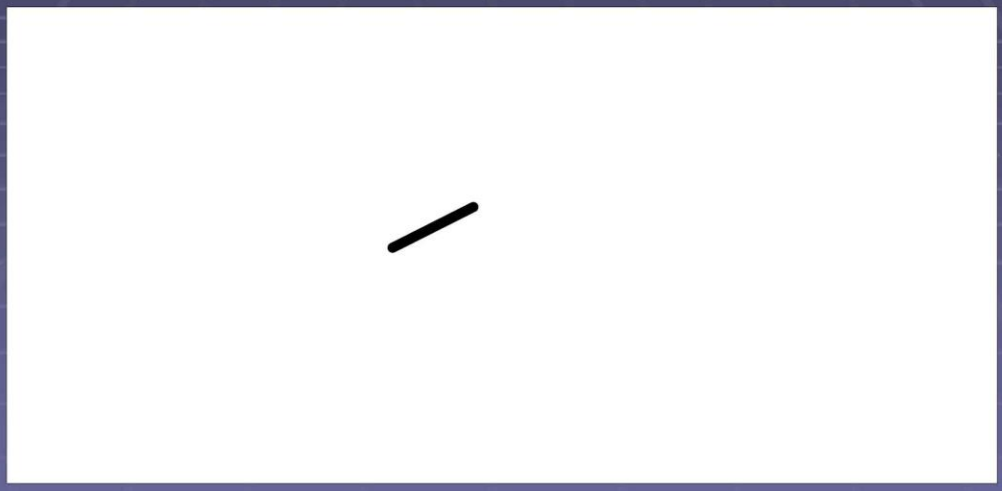
maximal shape operations

example with (colinear) maximal lines, intersection



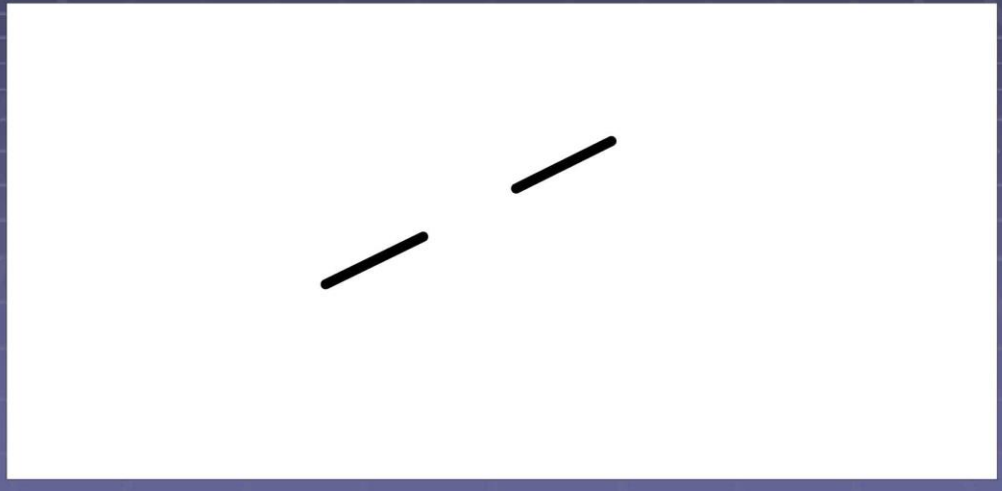
maximal shape operations

example with (colinear) maximal lines, intersection



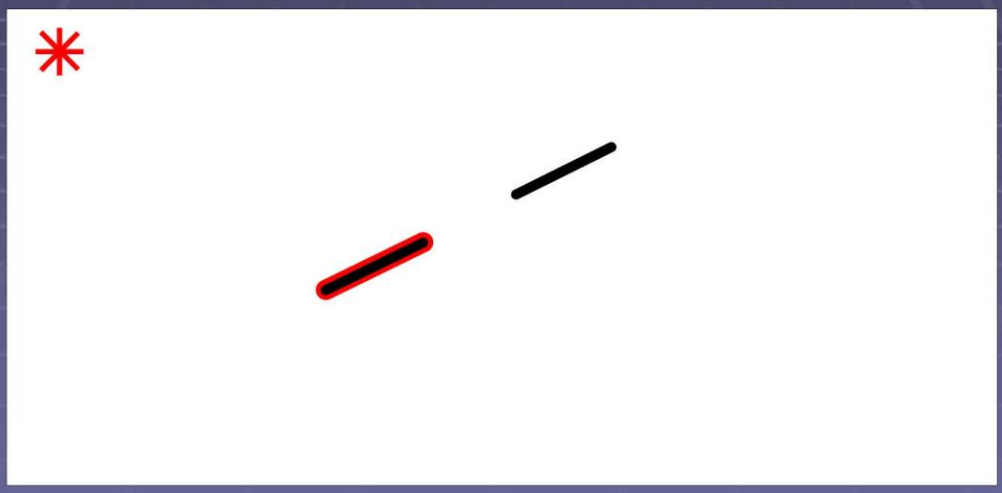
maximal shape operations

example with (colinear) maximal lines, intersection



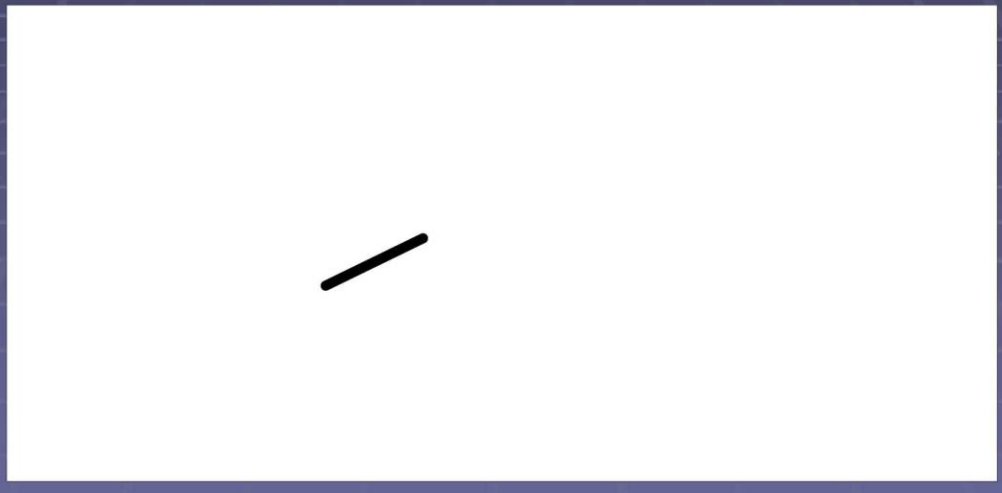
maximal shape operations

example with (colinear) maximal lines, intersection



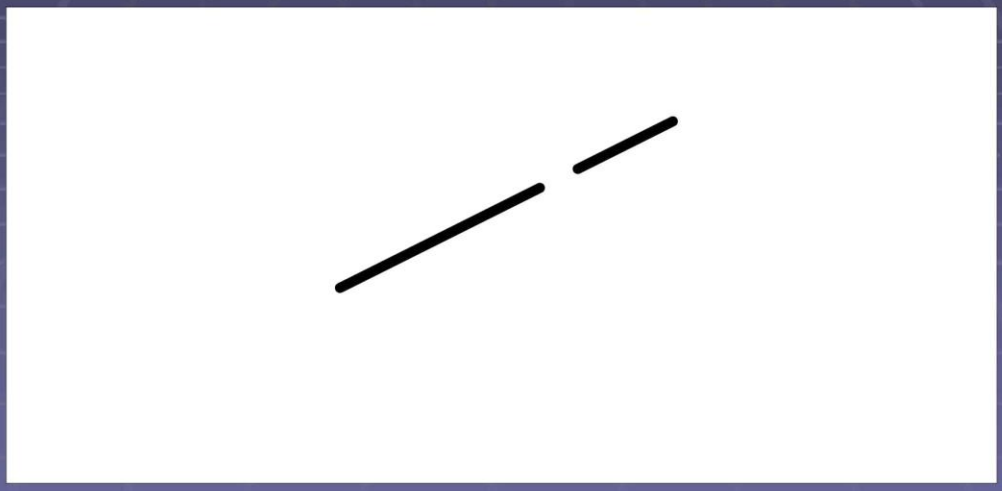
maximal shape operations

example with (colinear) maximal lines, intersection



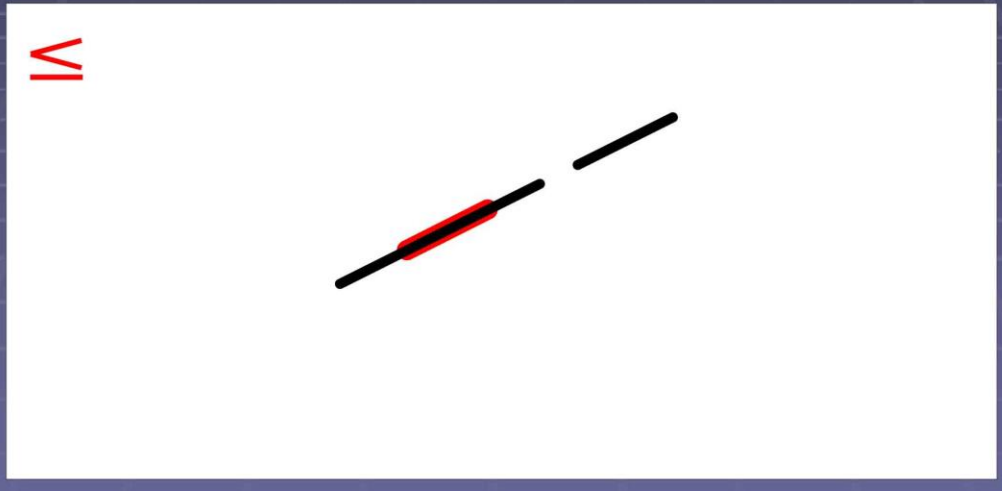
maximal shape operations

example with (colinear) maximal lines, sub-shape



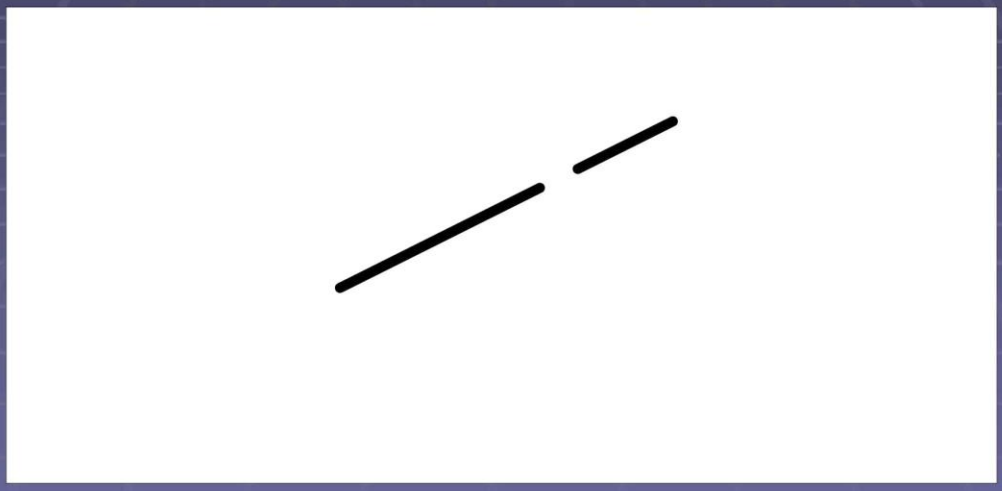
maximal shape operations

example with (colinear) maximal lines, sub-shape



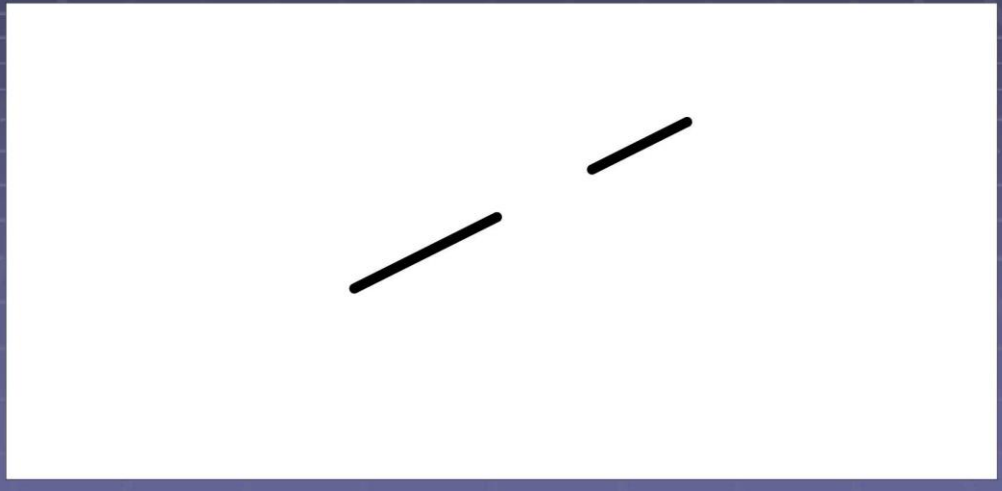
maximal shape operations

example with (colinear) maximal lines, sub-shape



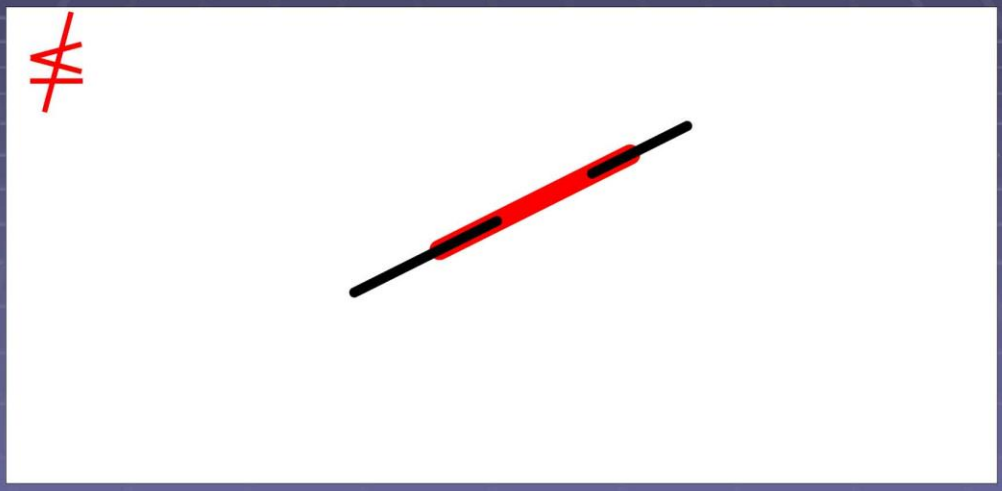
maximal shape operations

example with (colinear) maximal lines, sub-shape



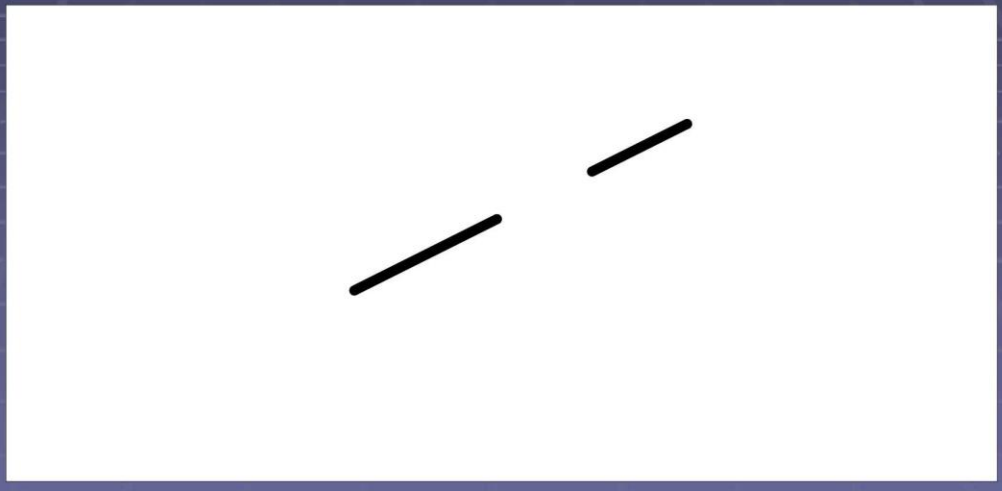
maximal shape operations

example with (colinear) maximal lines, sub-shape



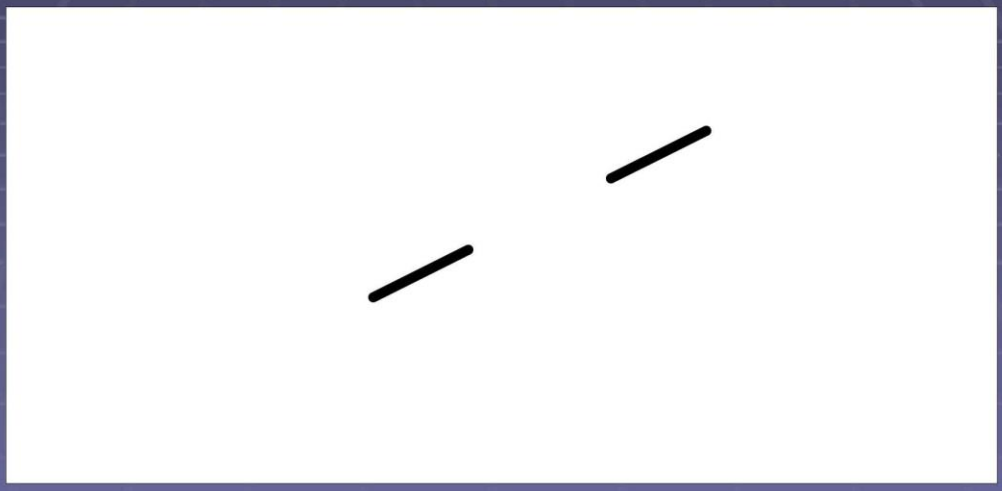
maximal shape operations

example with (colinear) maximal lines, sub-shape



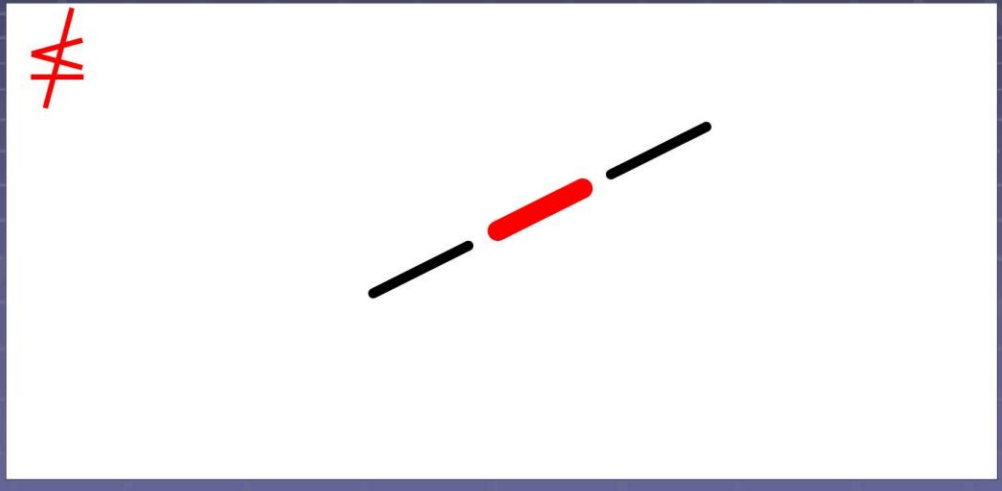
maximal shape operations

example with (colinear) maximal lines, sub-shape



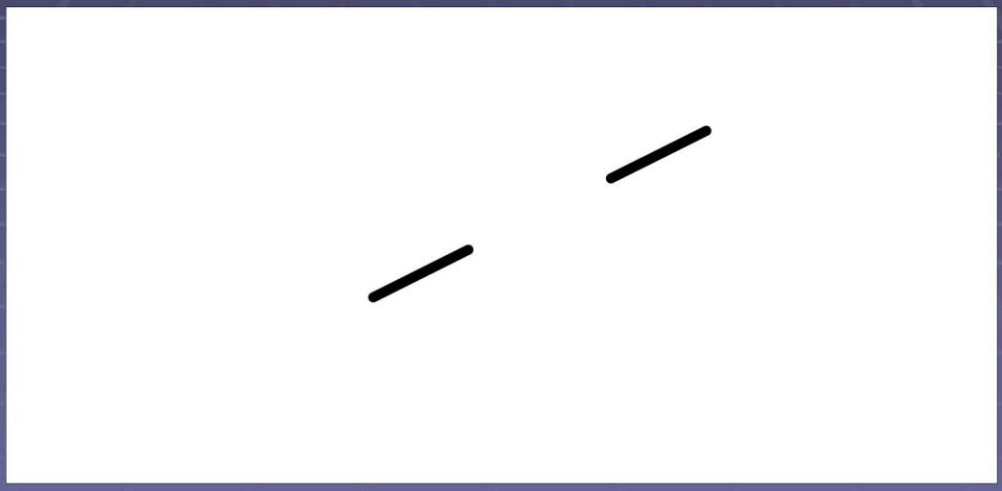
maximal shape operations

example with (colinear) maximal lines, sub-shape



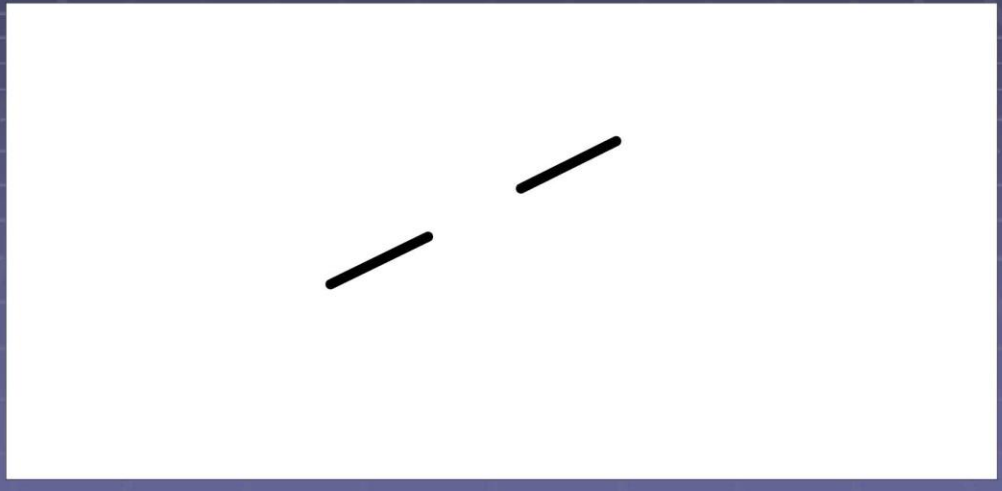
maximal shape operations

example with (colinear) maximal lines, sub-shape



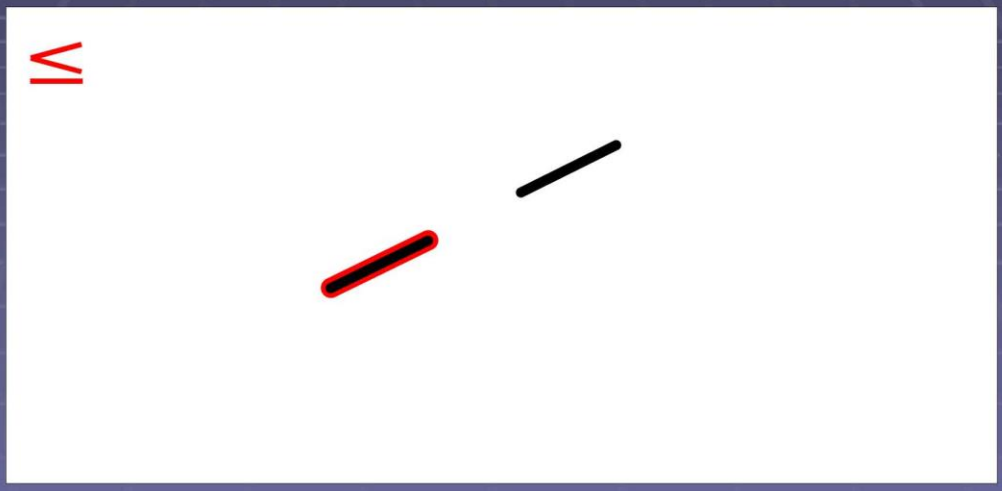
maximal shape operations

example with (colinear) maximal lines, sub-shape



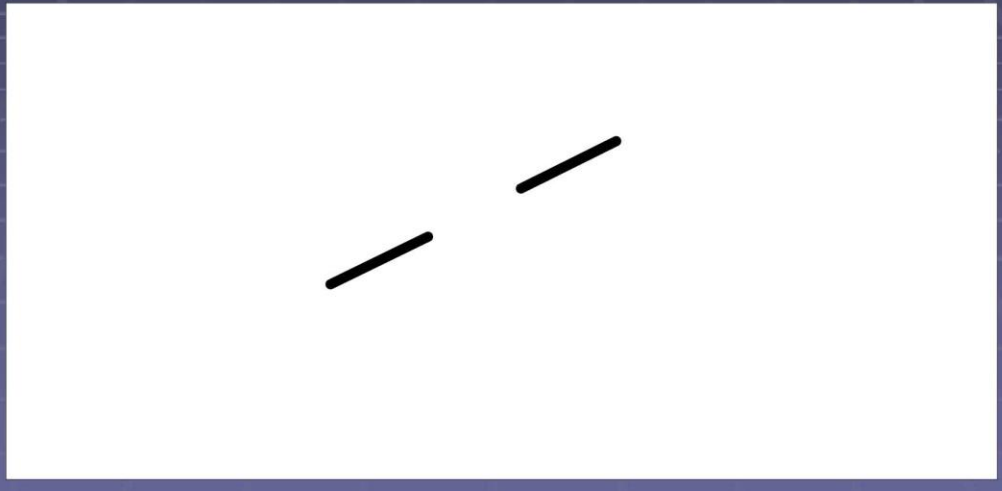
maximal shape operations

example with (colinear) maximal lines, sub-shape



maximal shape operations

example with (colinear) maximal lines, sub-shape



GSG shape operations

```
(defun sh+ (s1 s2 &optional name (maximal-p nil max-given-p))
  "The + (union) shape function operation."
  :  )

(defun sh- (s1 s2 &optional name (maximal-p nil max-given-p))
 "The - (difference) shape function operation."
  :  )

(defun sh* (s1 s2 &optional name (maximal-p nil max-given-p))
 "The * (intersection) shape function operation."
  :  )

(defun sh<= (s1 s2 &optional (maximal-p nil max-given-p))
 "The <= (sub-shape) shape function operation."
  :  )
```


GSG shape operations

```
(defun sh+ (s1 s2 &optional name (maximal-p nil max-given-p))
  "The + (union) shape function operation."
  :  )

(defun sh-
 "The - (di
  :  )

(defun sh*
 "The * (in
  :  )

(defun sh<=
 "The <= (s
  :  )
```

```
(defun sh= (s1 s2)
  "The = (equality comparator) shape function operation."
  :  )

(defun sh-cp (s &optional name (maximal-p nil max-given-p))
 "The copier shape function operation."
  :  )

(defun sh++ (s s2)
 "The + (union) shape procedure operation."
  :  )

(defun sh-- (s s2)
 "The - (difference) shape procedure operation."
  :  )

(defun sh** (s s2)
 "The * (intersection) shape procedure operation."
  :  )
```

testing shape operations

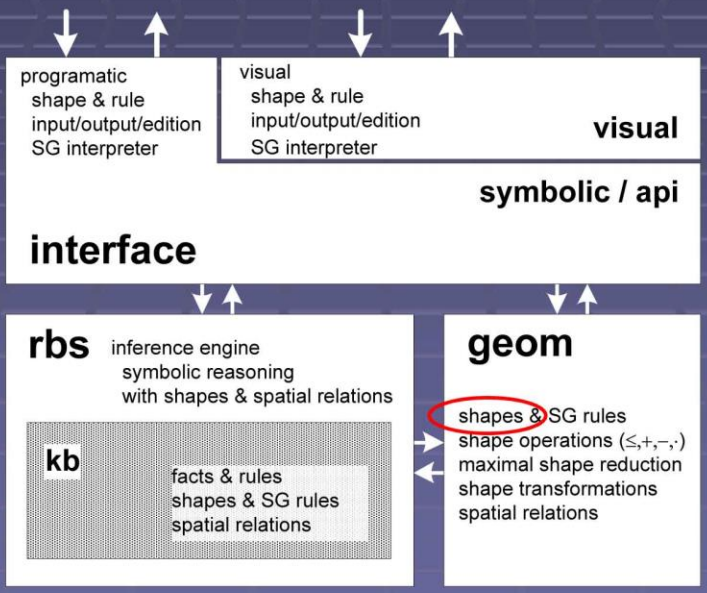
a shape in a test file (with 8 horizontal lines at y = 0)

```
(line :x1 10 :y1 0 :x2 30 :y2 0)
(line :x1 40 :y1 0 :x2 60 :y2 0)
(line :x1 70 :y1 0 :x2 90 :y2 0)
(line :x1 110 :y1 0 :x2 130 :y2 0)
(line :x1 150 :y1 0 :x2 170 :y2 0)
(line :x1 180 :y1 0 :x2 190 :y2 0)
(line :x1 200 :y1 0 :x2 210 :y2 0)
(line :x1 220 :y1 0 :x2 240 :y2 0)
```

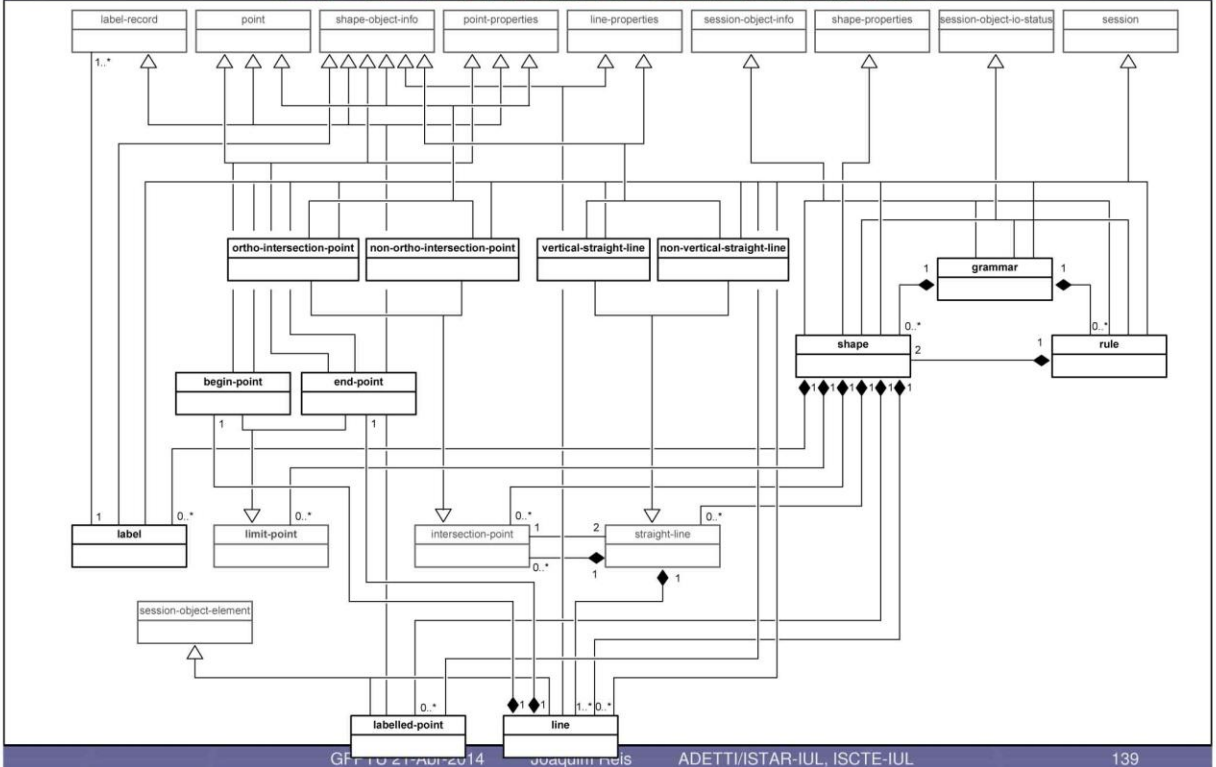
a test report file for ≤

```
        :
        :
test-shape-sub-slope0-case003  T
test-shape-sub-slope0-case002  T
test-shape-sub-slope0-case001  T
116 cases: 116 matches, 0 mismatches.
```


shape representation

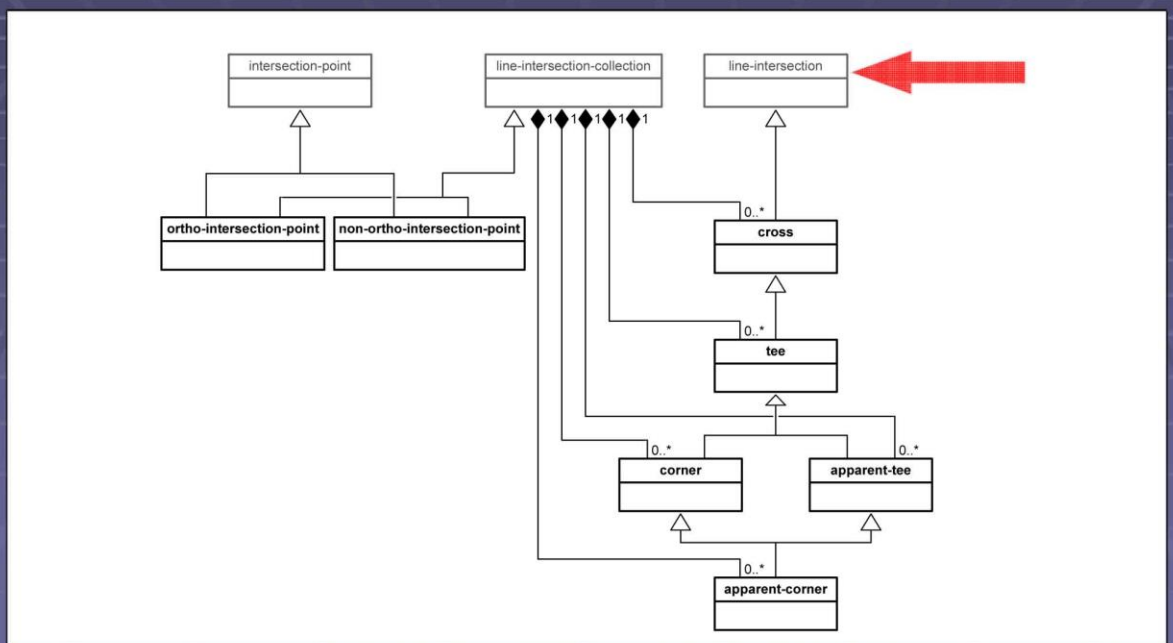


GSG main classes



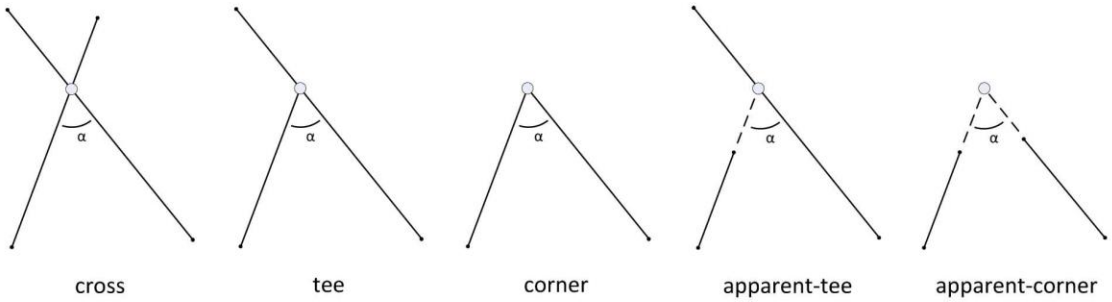
GSG main classes

a new beast: line intersections

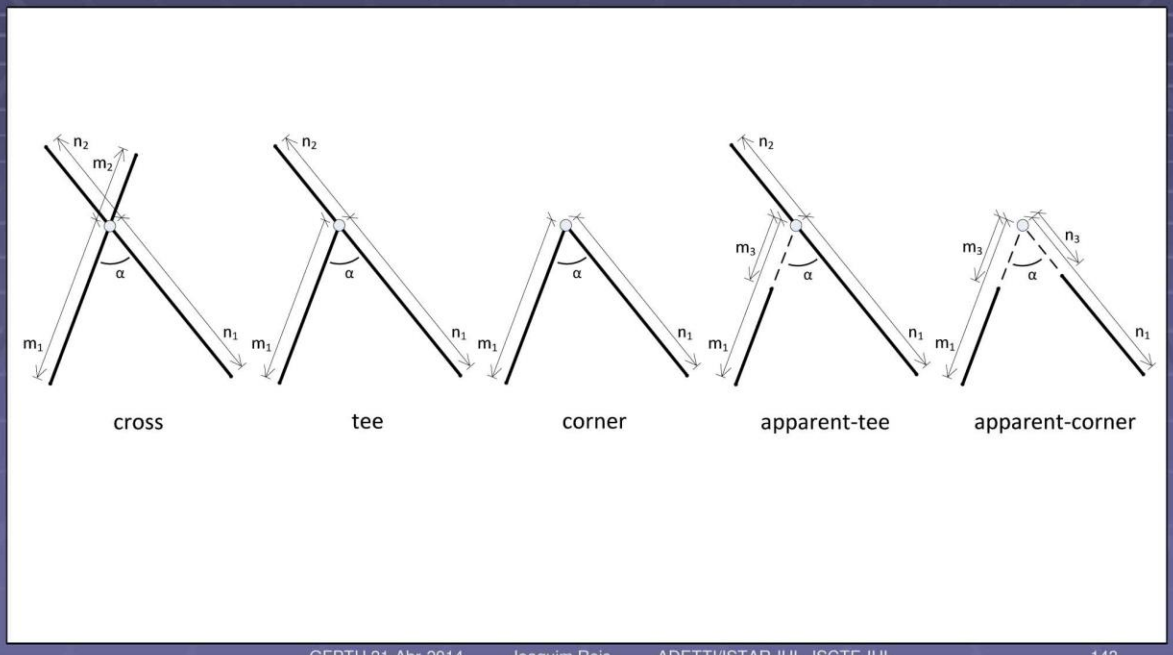


GSG main classes
line intersections

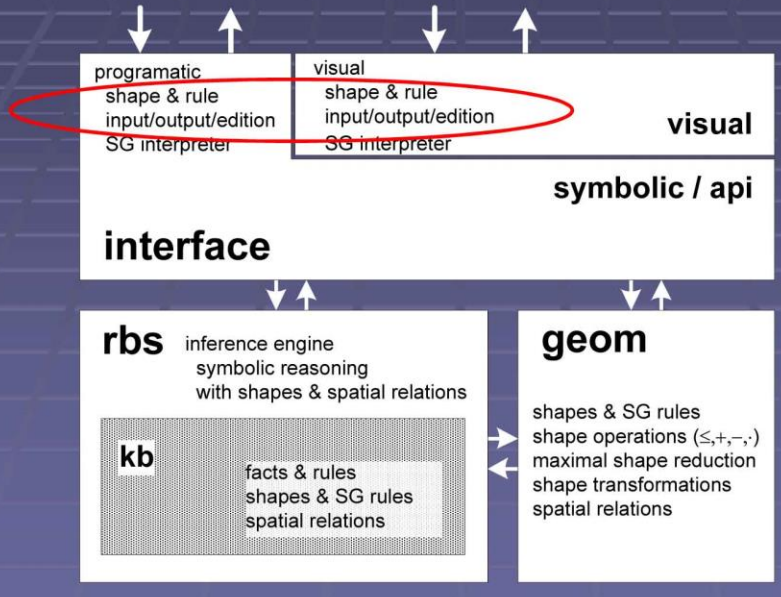
GSG main classes
line intersections



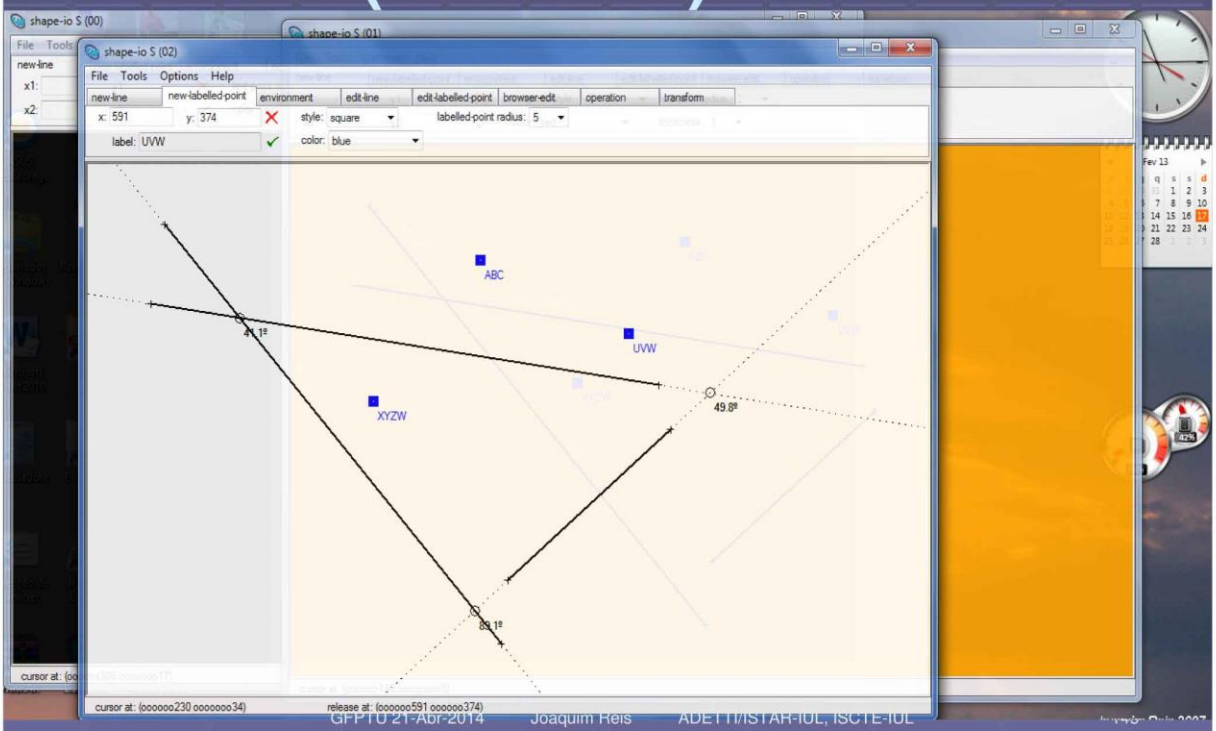
GSG main classes
line intersections



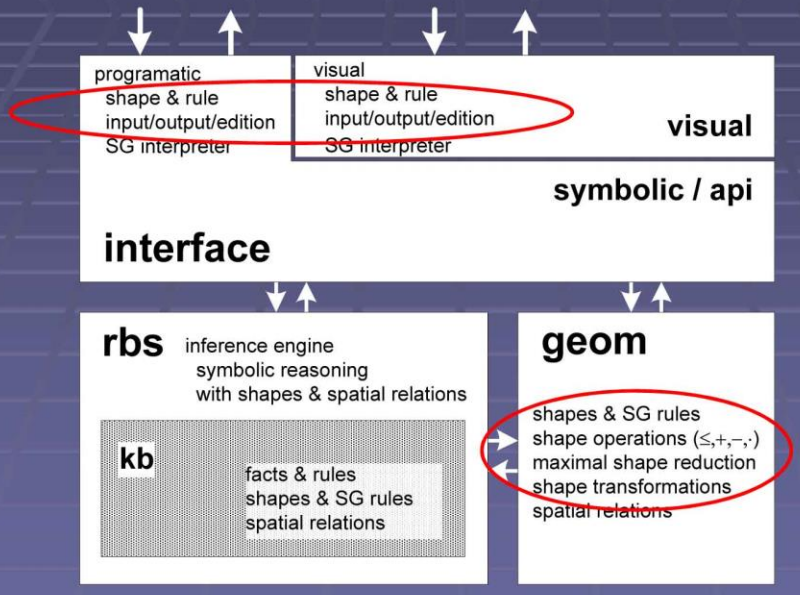
shape io/edition



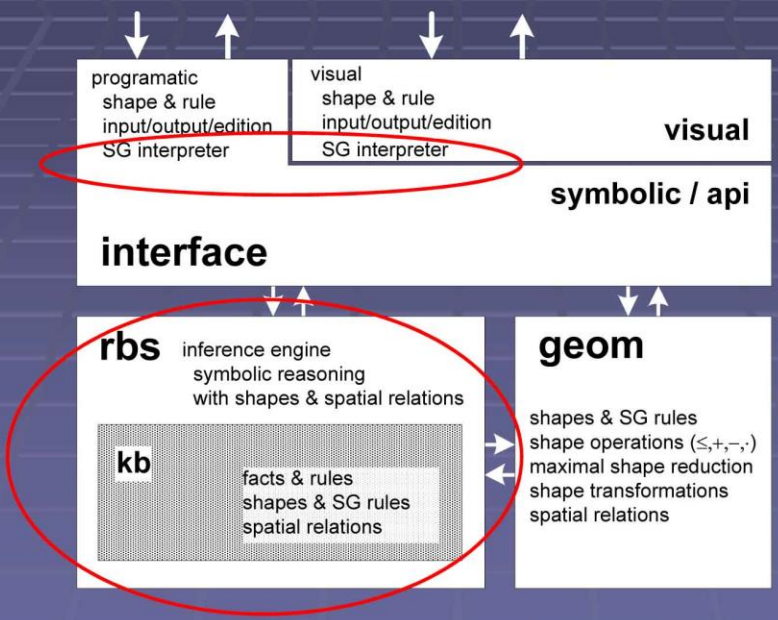
GSG (obsolete) interface



work in progress



future work



Joaquim Reis - GSG & Related Shape Grammar Publications

13. Alexandra Paio, Joaquim **Reis**, Filipe Santos, Pedro Faria Lopes, Sara Eloy, Vasco Rato, ***Emerg.cities4all, Towards a shape grammar based computational system tool for generating a sustainable and integrated urban design***, eCAADe 2011 Conference, Sept.21-24, 2011, Ljubljana, Slovenia.

14. **Reis**, J., Lopes, Santos, F., Eloy, S., Paio, A., Rato, V., ***Shape Grammars and Applications*** (comunicação oral), First Internatiuonal Workshop – NUIGraM – Natural User Interaction, Graphics and Mobility, Porto Salvo, Portugal, 2011.

15. **Reis**, Joaquim, ***GEOWIN – A System for Creative Pattern Generation Based on Rules***, ICSOFT 2009 - International Conference on Software and Data Technologies, Sofia, Bulgaria, July 26-29, 2009.

16. **Reis**, Joaquim, ***Rule Based Creative Pattern Generation for Visual Composition***, CISTI 2009, Actas da 4ª Conferência Ibérica de Sistemas e Tecnologias de Informação, AISTI/FEUP/UFP, 17 a 20 de Junho de 2009, Póvoa de Varzim, Portugal.

17. **Reis**, Joaquim, ***Using Rules for Creativity in Visual Composition***, SIGDOC 2008, 26th ACM International Conference on Design in Communication, Lisboa, Portugal, 22-24 Setembro de 2008.

18. **Reis**, Joaquim, ***A Rule Language to Express Visual Pattern Generation***, (*poser*), SIGDOC 2008, 26th ACM International Conference on Design in Communication, Lisboa, Portugal, 22-24 Setembro de 2008.

19. **Reis**, Joaquim, ***Agents, Grammars and Style: Multi-Agent Visual Composition with Shape Grammars***, ICWI 2006 - IADIS International Conference WWW/Internet 2006, 5-8 de Outubro de 2006, Murcia, Espanha.

20. **Reis**, Joaquim, ***An Approach to Multi Agent Visual Composition with Mixed Styles***, ICSOFT 2006, International Conference on Software and Data Technologies, 11-14 Setembro de 2006, Setúbal, Portugal.

21. **Reis**, Joaquim, ***Agents with Style – Multi-Agent Visual Composition with Shape Grammars***, (*short paper*), Third Joint Workshop on Computational Creativity (ECAI 2006 Workshop MT2, ECAI 2006, European Conference on Artificial Intelligence), 28-29 Agosto de 2006, Riva del Garda, Itália.

22. **Reis**, Joaquim, ***Agentes com Estilo próprio, Composição Visual Multi-Agente com Gramáticas de Forma***, CISTI 2006, 1st Iberic Conference on Information Systems and Technologies, 21-23 Junho de 2006, Ofir, Portugal (em português).

Technical Reports

21. **Reis**, Joaquim, ***Implementação e Visualização de Formas em GSG***, Relatório Técnico do Departamento de Ciências e Tecnologias de Informação do ISCTE-IUL e da ADETTI-IUL, de Outubro de 2011.

22. **Reis**, Joaquim, ***GSG - Generic Shape Grammars, Technologies and Computational System Architecture for an Expert System Shell for Shape Grammars***, Relatório Técnico do Departamento de Ciências e Tecnologias de Informação do ISCTE-IUL e da ADETTI-IUL, de Fevereiro de 2011.

Joaquim Reis - GSG & Related Shape Grammar Publications

Conferences

1. **Reis**, Joaquim, ***Crossing Lines in GSG***, aceite no ISDOC 2014, International Conference on Information Systems and Design of Communication, de 16 a 17 de Maio de 2014, Lisboa, Portugal.
2. **Reis**, Joaquim, ***A Tool for Knowledge-Based Visual Creativity Support*** (comunicação oral), 1st-SUWMIAC – Summer Workshop Microsoft – ISCTE-IUL on Applied Computing, Lisboa, Portugal, 5 de Setembro de 2013.
3. **Reis**, Joaquim, ***A Shell Tool for Visual Creativity Support***, ISDOC 2013, International Conference on Information Systems and Design of Communication, de 11 a 12 de Julho de 2013, Lisboa, Portugal.
4. Santos, Filipe e **Reis**, Joaquim, ***A Language for Automatic Design Generation***, ISDOC 2013, International Conference on Information Systems and Design of Communication, de 11 a 12 de Julho de 2013, Lisboa, Portugal.
5. **Reis**, Joaquim, ***GSG, A Tool for Knowledge-Based Visual Creativity***, CISTI 2013, 8ª Conferência Ibérica de Sistemas e Tecnologias de Informação, de 19 a 22 de Junho de 2013, Lisboa, Portugal.
6. Tching, Joana, **Reis**, Joaquim, Paio, Alexandra, ***Shape Grammars for Creative Decisions in the Architectural Project***, CISTI 2013, 8ª Conferência Ibérica de Sistemas e Tecnologias de Informação, de 19 a 22 de Junho de 2013, Lisboa, Portugal.
7. Joana Tching, Alexandra Paio, Joaquim **Reis**, ***A Shape Grammar for Self-Built Housing***, SIGraDi 2012, XVI Congress of Iberoamerican Society of Digital Graphics, 13 a 16 de Novembro de 2012, Fortaleza, Brasil.
8. Alexandra Paio, Vasco Moreira Rato, Joaquim **Reis**, Filipe Santos, Pedro Faria Lopes, ***Emerg.cities4all: generating a computational tool for sustainable social urban design in Portuguese speaking countries***, poster, Conferência Internacional PNUM 2012 - Portuguese Network of Urban Morphology, 5-6 de Julho de 2012, ISCTE-IUL, Lisboa, Portugal.
9. Sara Eloy, Alexandra Paio, Joaquim **Reis**, Filipe Santos, Vasco Moreira Rato, Pedro Faria Lopes, ***Using Shape Grammar to design Emerg.cities4all***, submetido e aceite para publicação como poster à conferência Nexus 2012: The 9th Interdisciplinary Conference for Architecture and Mathematics, de 11 a 14 de Junho de 2012 em Milão, Itália.
10. Filipe Santos, Joaquim **Reis**, Pedro Lopes, Alexandra Paio, Sara Eloy, Vasco Rato, ***A Multi-Agent Expert System Shell for Shape Grammars***, CAADRIA 2012, The 17th International Conference on Computer-Aided Architectural Design Research in Asia, de 25 a 28 de Abril de 2012, Chennai, India.
11. Pedro Faria Lopes, Joaquim **Reis**, Filipe Santos, Sara Eloy, Alexandra Paio, Vasco Rato, ***Shaping emergent cities for all***, conferência SIGraDi 2011, de 16 a 18 de Novembro de 2011, Santa Fe, Argentina.
12. Alexandra Paio, Sara Eloy, Joaquim **Reis**, Filipe Santos, Vasco Rato, Pedro Faria Lopes, ***Emerg.cities4all: Towards a sustainable and integrated urban design***, UIA 2011 Tokyo 24th World Congress of Architecture, Sept.25-Oct.1, 2011, Tokyo, Japan,.

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13. Alexa
comp
Ljubl
14. **Reis**,
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15. **Reis**,
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16. **Reis**,
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17. **Reis**,
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21. **Reis**,
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Garda
22. **Reis**,
Confe

Technica

21. **Reis**,
Inform
22. **Reis**,
Shell
Fevereiro de 2011.

2

GSG
a *shell* tool for
shape grammar support

Joaquim Reis

Dept. Ciências e Tecnologias de Informação
ISCTE-IUL/ADETTI-IUL
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GFTU - Gramáticas de Forma para Transformação Urbana,
April 21th, 2014, ADETTI / ISTAR-IUL, ISCTE-IUL

A Interface para o Sistema GSG

Paulo Canilho

Professor Doutor Coordenador de Projecto - Joaquim Reis

Aluno Bolseiro - Paulo Canilho

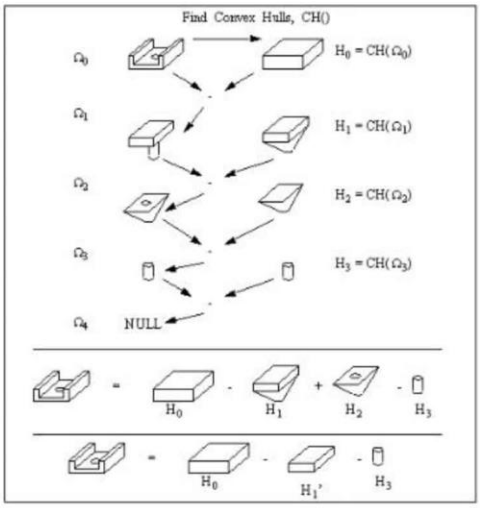
Introdução

- O que é o GSG ?
  - Descrição
- Interface Gráfica
  - Desactualizada
    - Problemas
  - Proposta

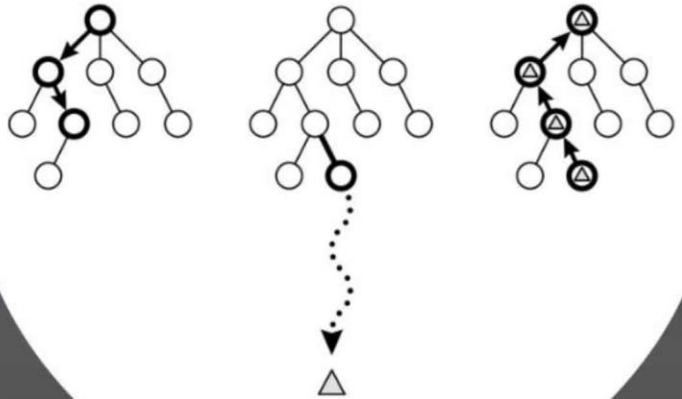
GSG

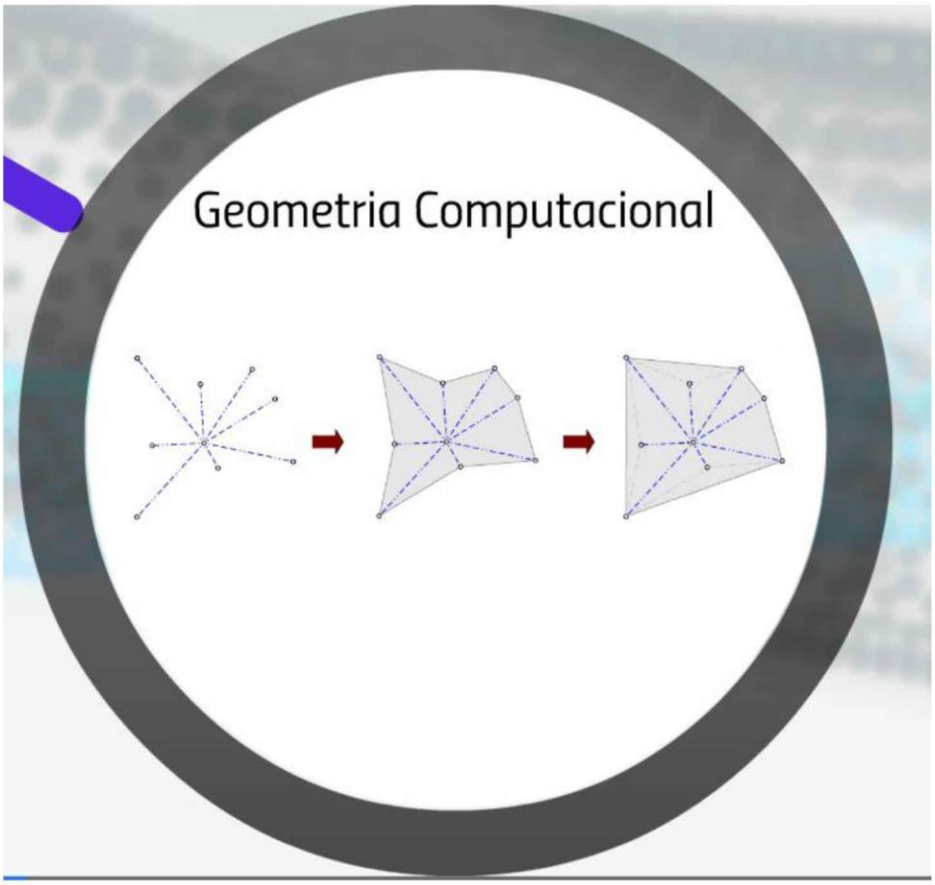
- Descrição

Shape Grammar

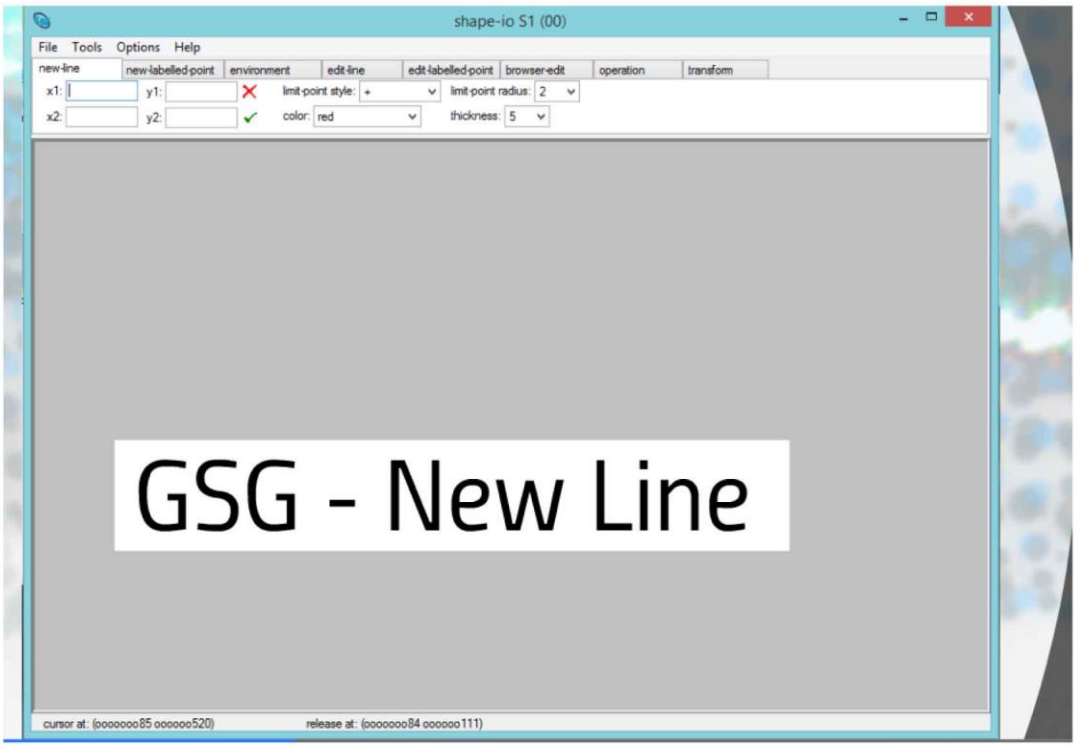


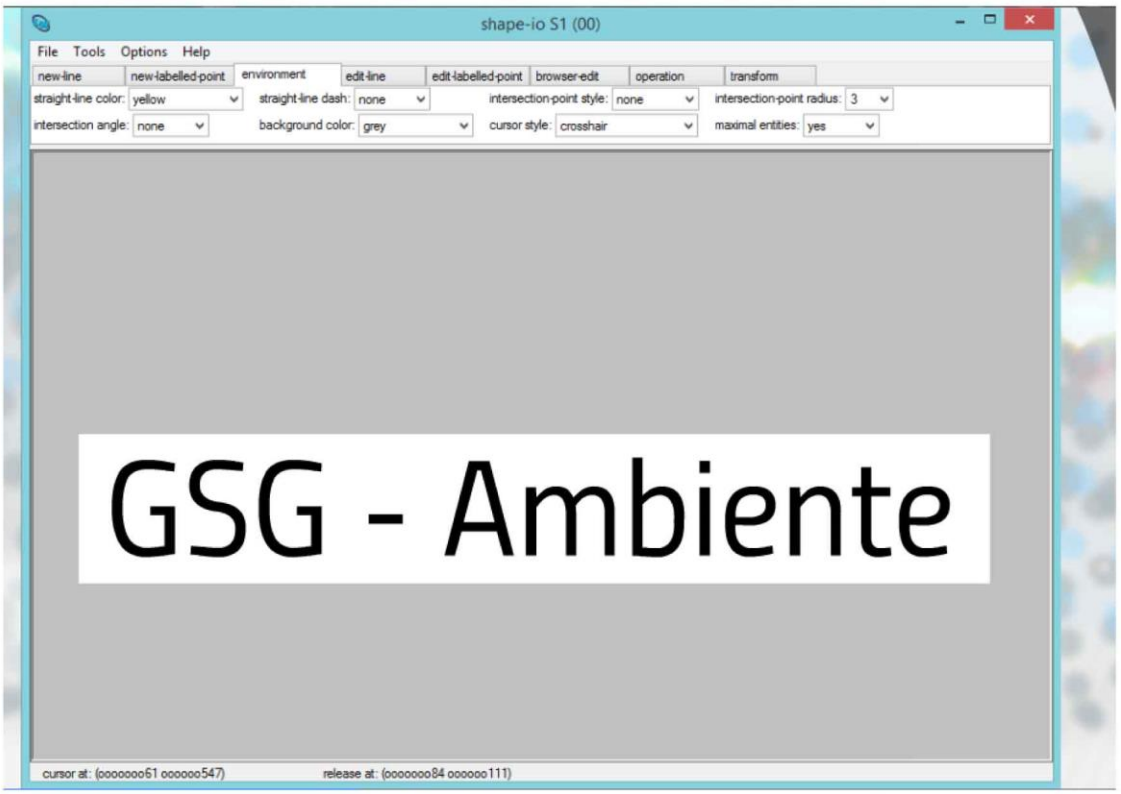
Inteligência Artificial




Geometria Computacional


Interface Gráfica (Desactualizada)
GSG - Ambiente
GSG - New Line


shape-io S1 (00)
File Tools Options Help
new-line
new-labelled-point
environment
edit-line
edit-labelled-point
browser-edit
operation
transform
x1:
y1:
x2:
y2:
limit-point style: +
limit-point radius: 2
color: red
thickness: 5
GSG - New Line
cursor at: (oooooo85 ooooo520)
release at: (oooooo84 ooooo111)


shape-io S1 (00)
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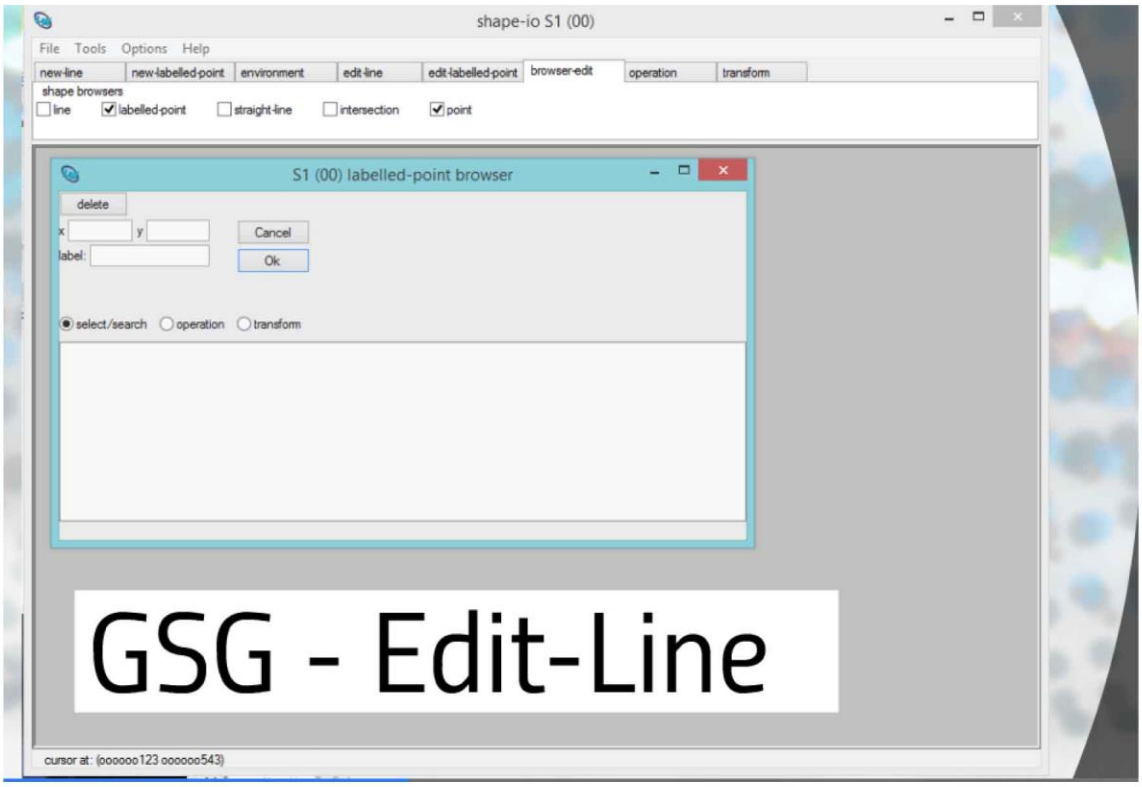
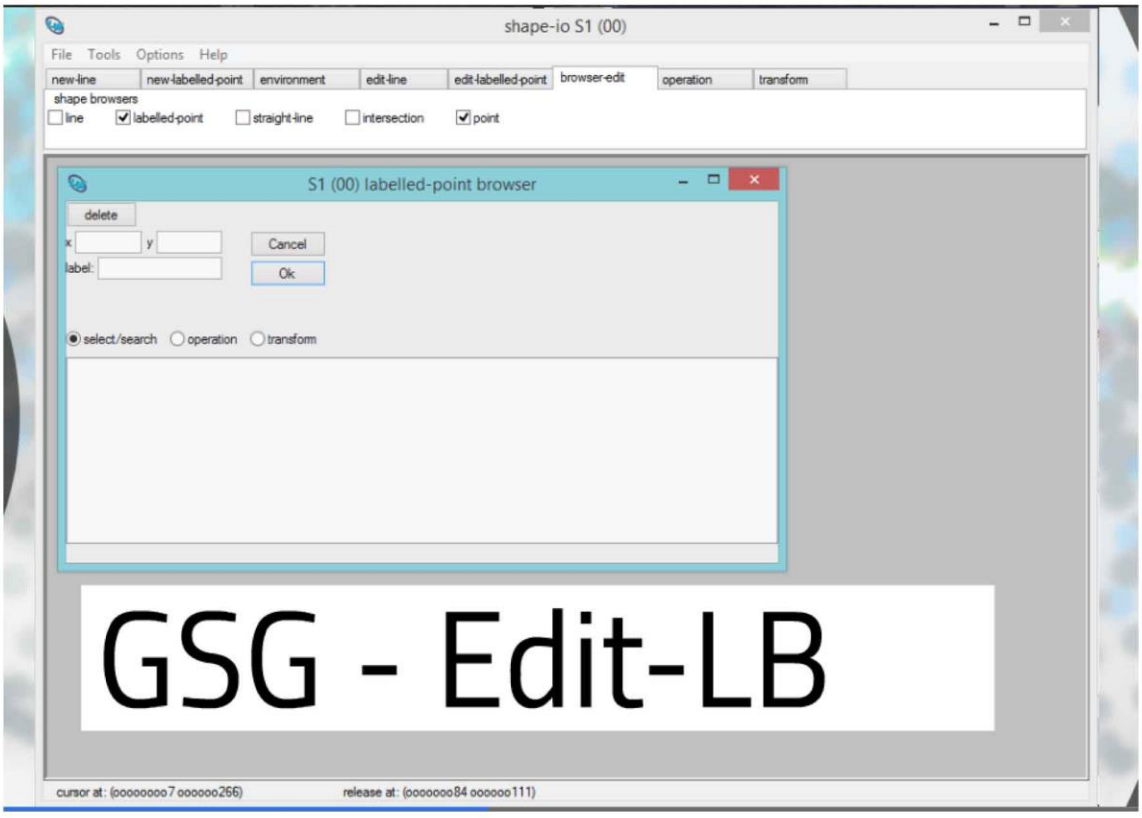
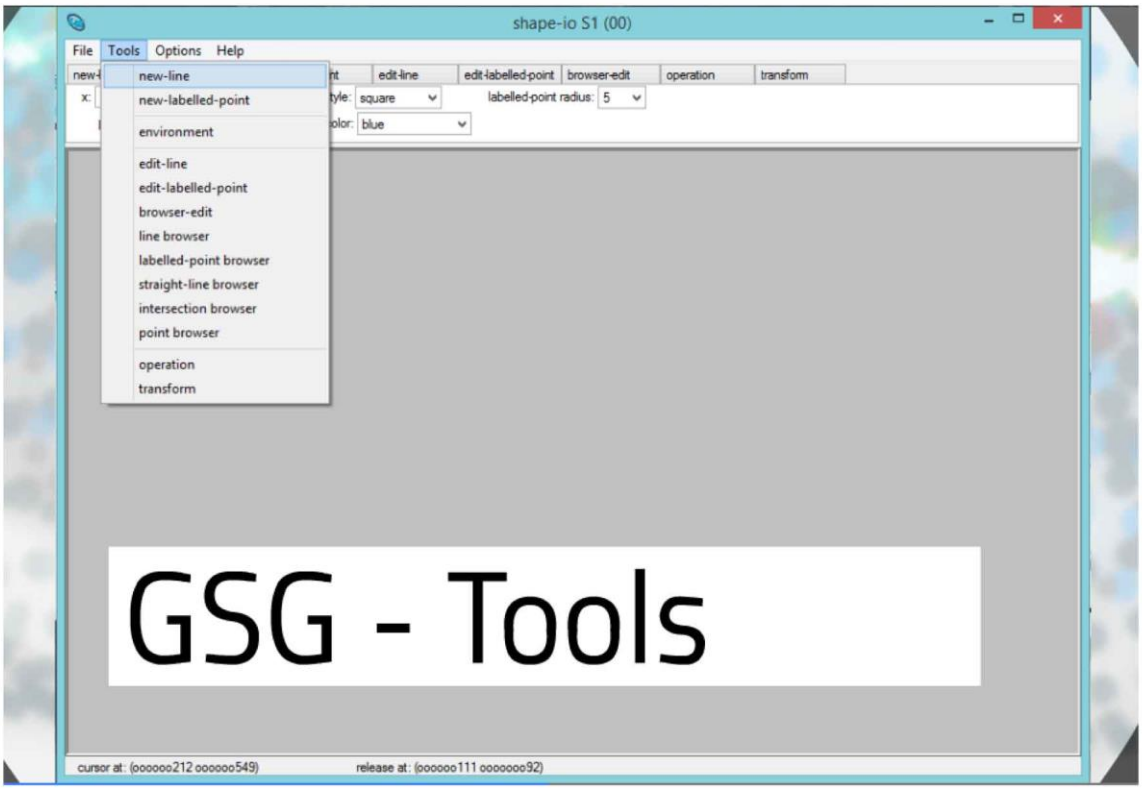
new-line
new-labelled-point
environment
edit-line
edit-labelled-point
browser-edit
operation
transform
straight-line color: yellow
straight-line dash: none
intersection-point style: none
intersection-point radius: 3
intersection angle: none
background color: grey
cursor style: crosshair
maximal entities: yes
GSG - Ambiente
cursor at: (oooooo61 ooooo547)
release at: (oooooo84 ooooo111)

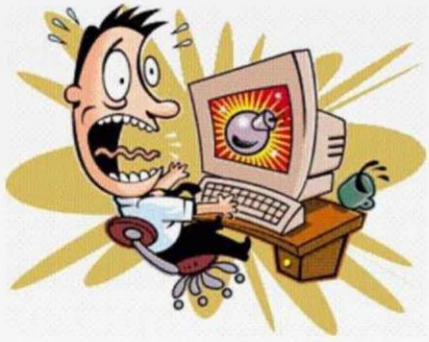

shape-io S1 (00)
File Tools Options Help
new-line
new-labelled-point
environment
edit-line
edit-labelled-point
browser-edit
operation
transform
shape browsers
line
labelled-point
straight-line
intersection
point
S1 (00) labelled-point browser
delete
x
y
Cancel
label:
Ok
select/search
operation
transform
GSG - Edit-Line
cursor at: (ooooo123 ooooo543)


shape-io S1 (00)
File Tools Options Help
new-line
new-labelled-point
environment
edit-line
edit-labelled-point
browser-edit
operation
transform
shape browsers
line
labelled-point
straight-line
intersection
point
S1 (00) labelled-point browser
delete
x
y
Cancel
label:
Ok
select/search
operation
transform
GSG - Edit-LB
cursor at: (oooooooo7 ooooo266)
release at: (oooooo84 ooooo111)

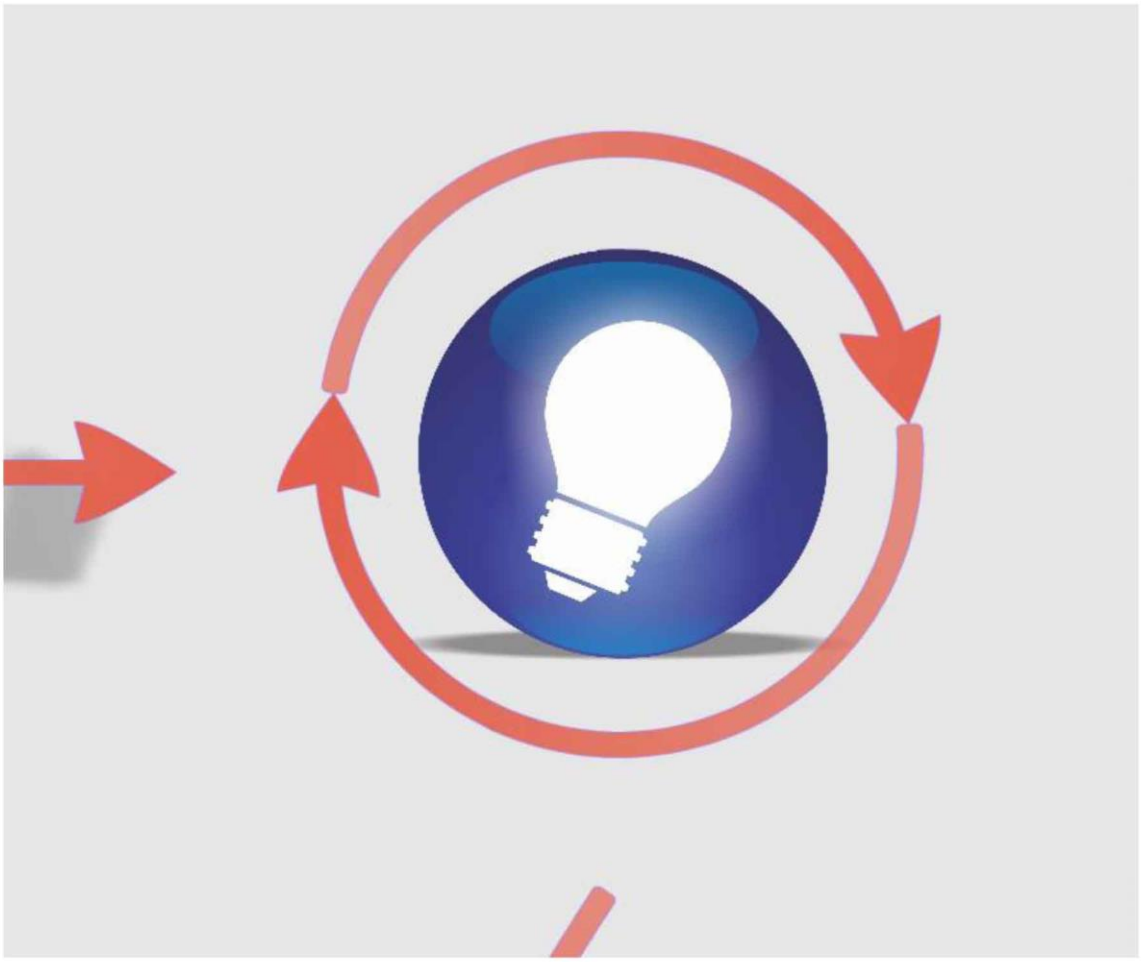


Problemas

- Janelas desagrupadas;
- Poucas funcionalidades de edição;
- Falta de apoio na criação de formas;
- e.t.c.



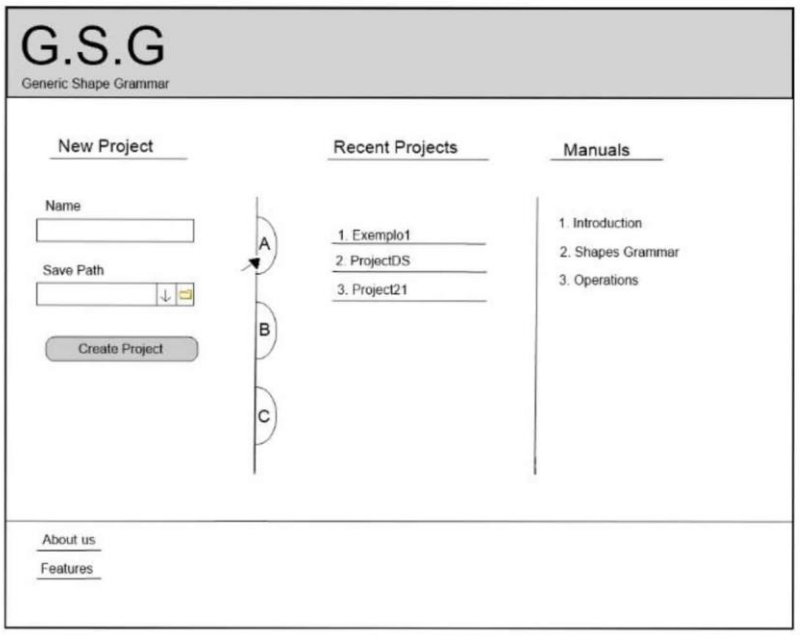
Difícil utilização pelo utilizador!



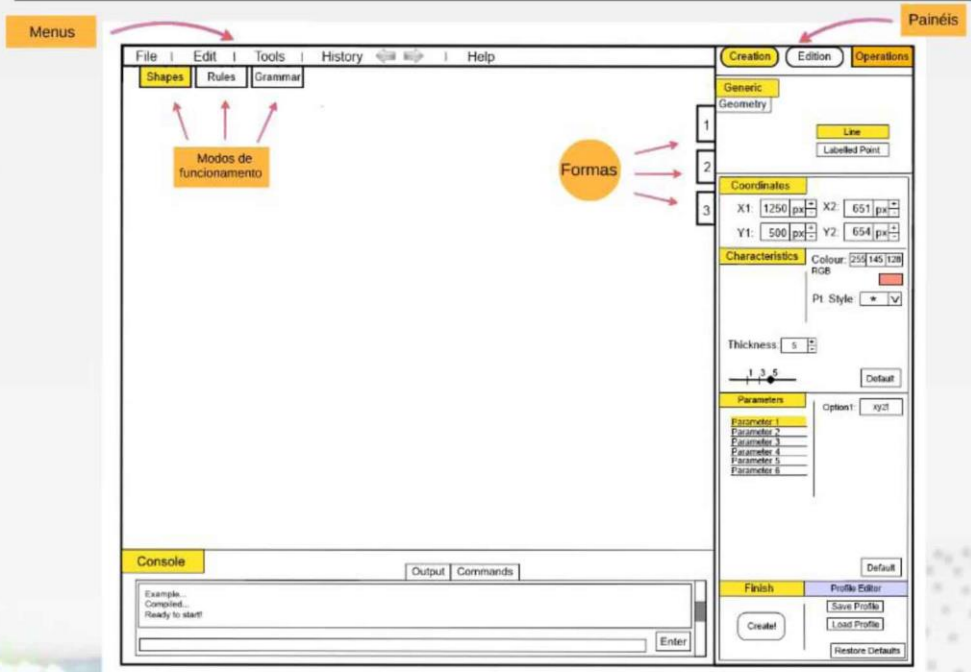
Proposta

- Eliminar o uso de janelas secundárias;
- Agrupar funcionalidades em painés dimensionáveis;
- Desenvolver ferramentas de ajuda para a criação de formas;
- Implementar layouts e funcionalidades "User Friendly";

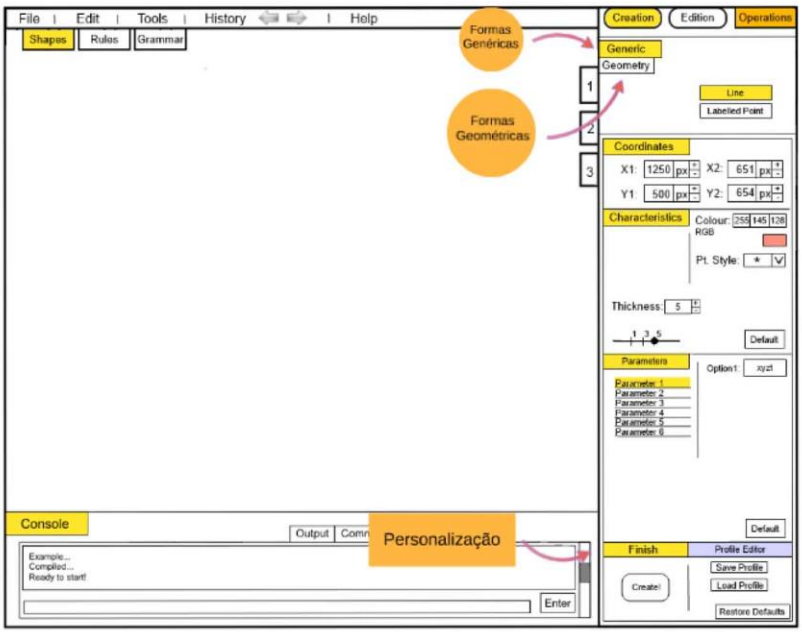
Janela de Apresentação



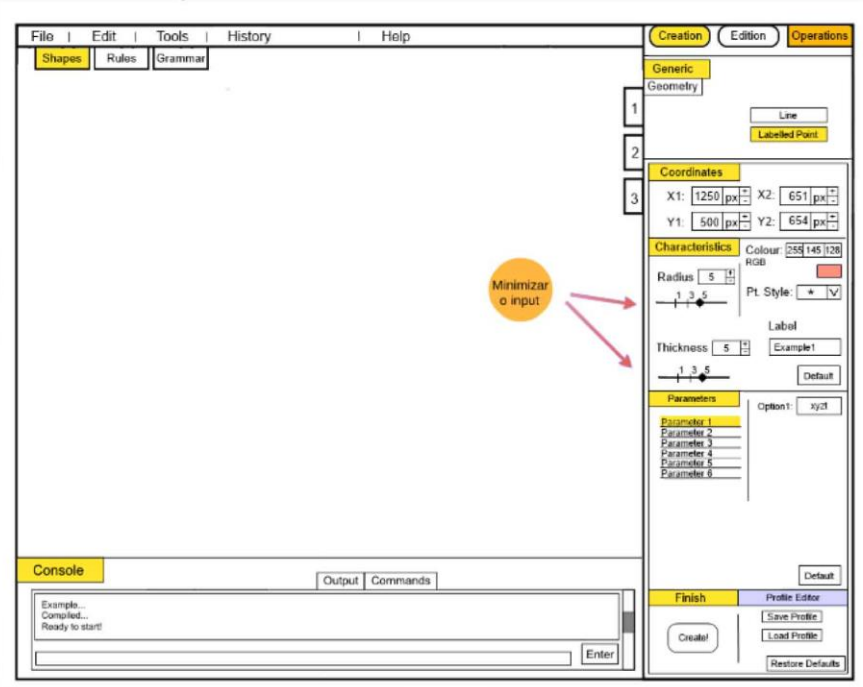
Criação



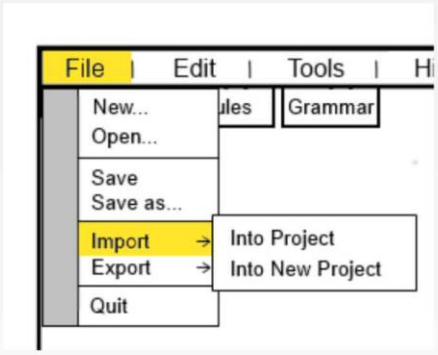
Criação - Generic/Line

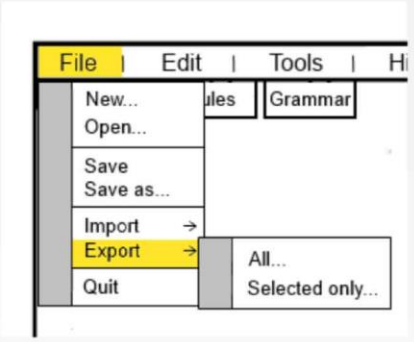


Criação - Generic/Labelled Point

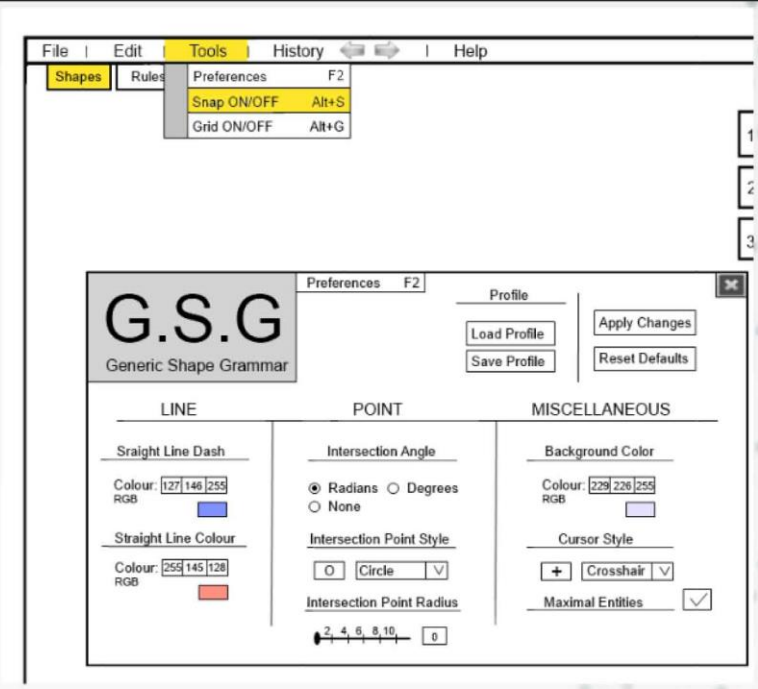


File - Import/Export

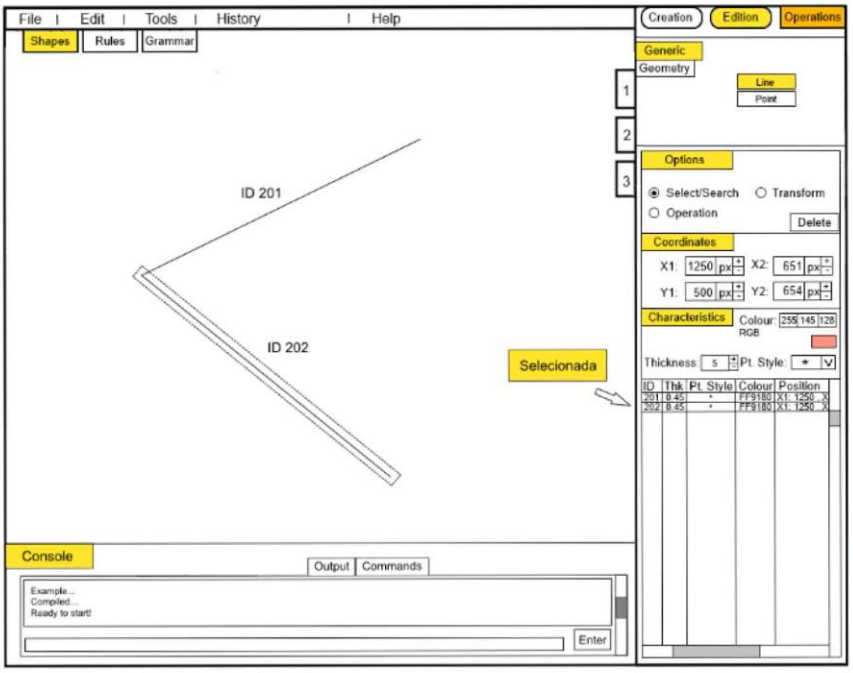




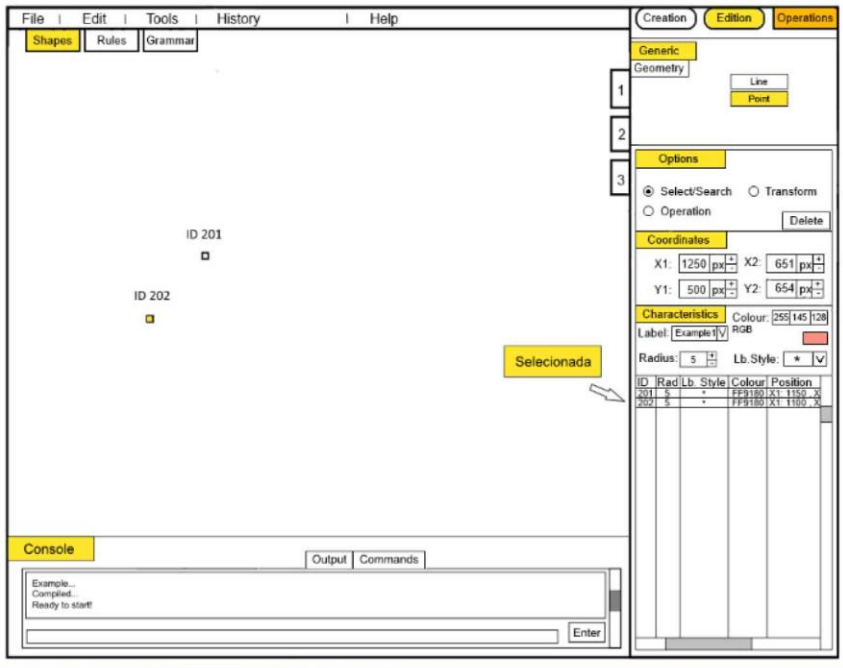
File - Tools/Preferences



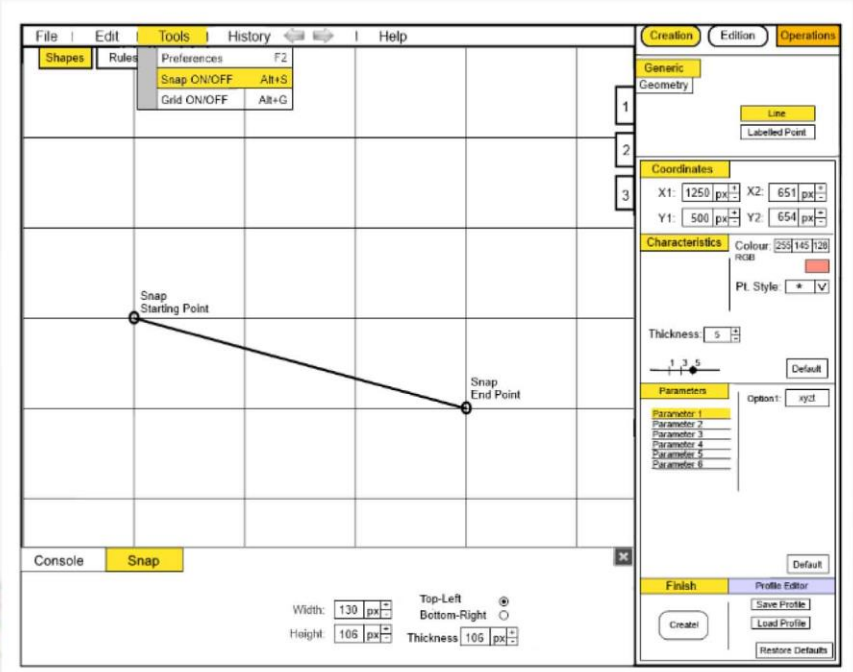
Edição - Line



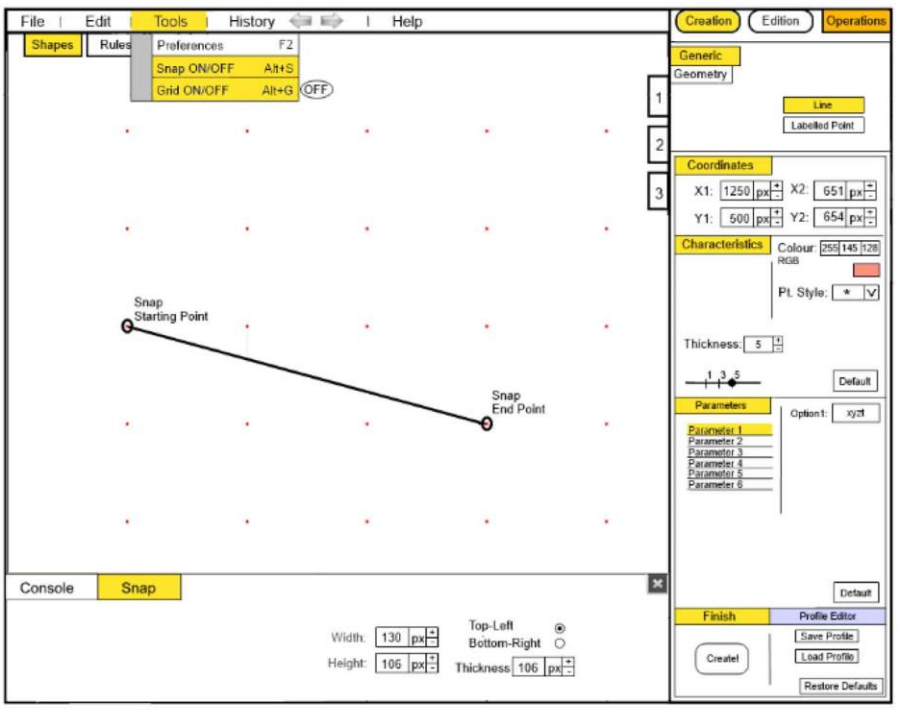
Edição - Labelled Point



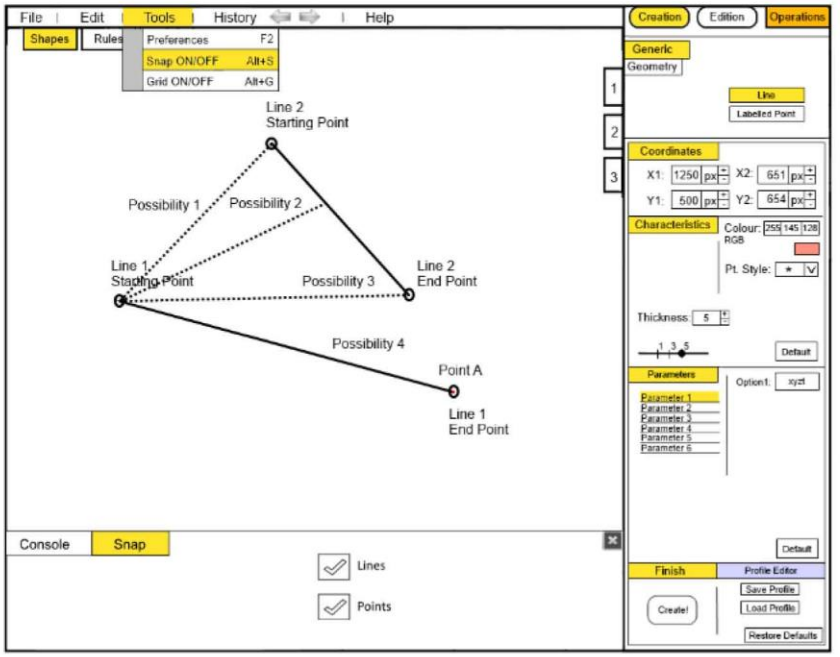
File - Snap/Grid



File - Snap/Grid



File - Line/Point



Bibliografia

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- Reis, Joaquim, Using Rules for Creativity in Visual Composition, 2008, Lisboa.
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Sistemas de Informação Geográfica e City Engine

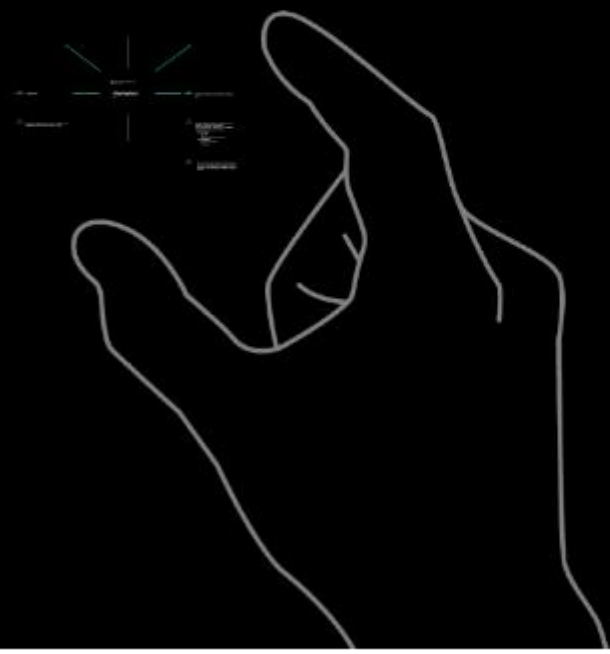
Rui Ricardo, Rúben Reis

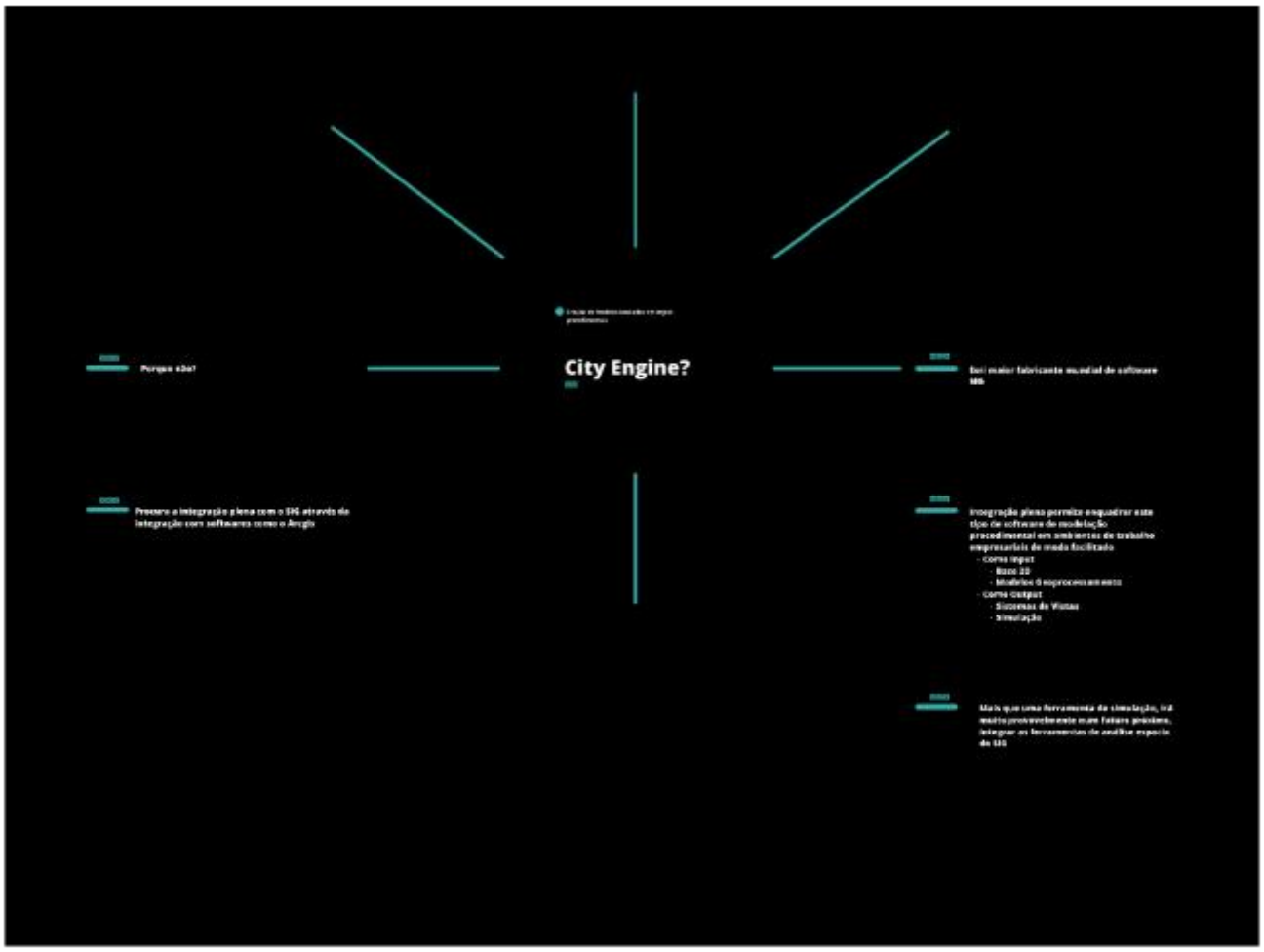
http://prezi.com/qt1adw5fi_ru/cityengine/

Ruben

GEOBIM

Rui Ricardo
ISCTE-IUL/CML




Criação de modelos baseados em regras procedimentais
Porquê não?
City Engine?
Esri maior fabricante mundial de software SIG
Promove a integração plena com o SIG através da integração com softwares como o Arcgis
Integração plena permite enquadrar este tipo de software de modelação procedimental em ambientes de trabalho empresariais de modo facilitado
- Como input
- Bases 2D
- Modelos 0 reprocessamento
- Como output
- Sistemas de Vistas
- Simulação
Mais que uma ferramenta de simulação, irá muito provavelmente num futuro próximo, integrar as ferramentas de análise espacial de SIG


Criação de modelos baseados em regras procedimentais
City Engine?

- Porque não?

- Procura a integração plena com o SIG através da integração com softwares como o Arcgis

Esri maior fabricante mundial de software SIG

Integração plena permite enquadrar este tipo de software de modelação procedimental em ambientes de trabalho empresariais de modo facilitado

- Como Input
  - Base 2D
  - Modelos Geoprocessamento
- Como Output
  - Sistemas de Vistas
  - Simulação

Mais que uma ferramenta de simulação, irá muito provavelmente num futuro próximo, integrar as ferramentas de análise espacia do SIG

XXXXX

http://prezi.com/qt1adw5fi_ru/cityengine/

Ruben

CITYENGINE

UMA NOVA PERSPECTIVA PARA O PLANEAMENTO URBANO

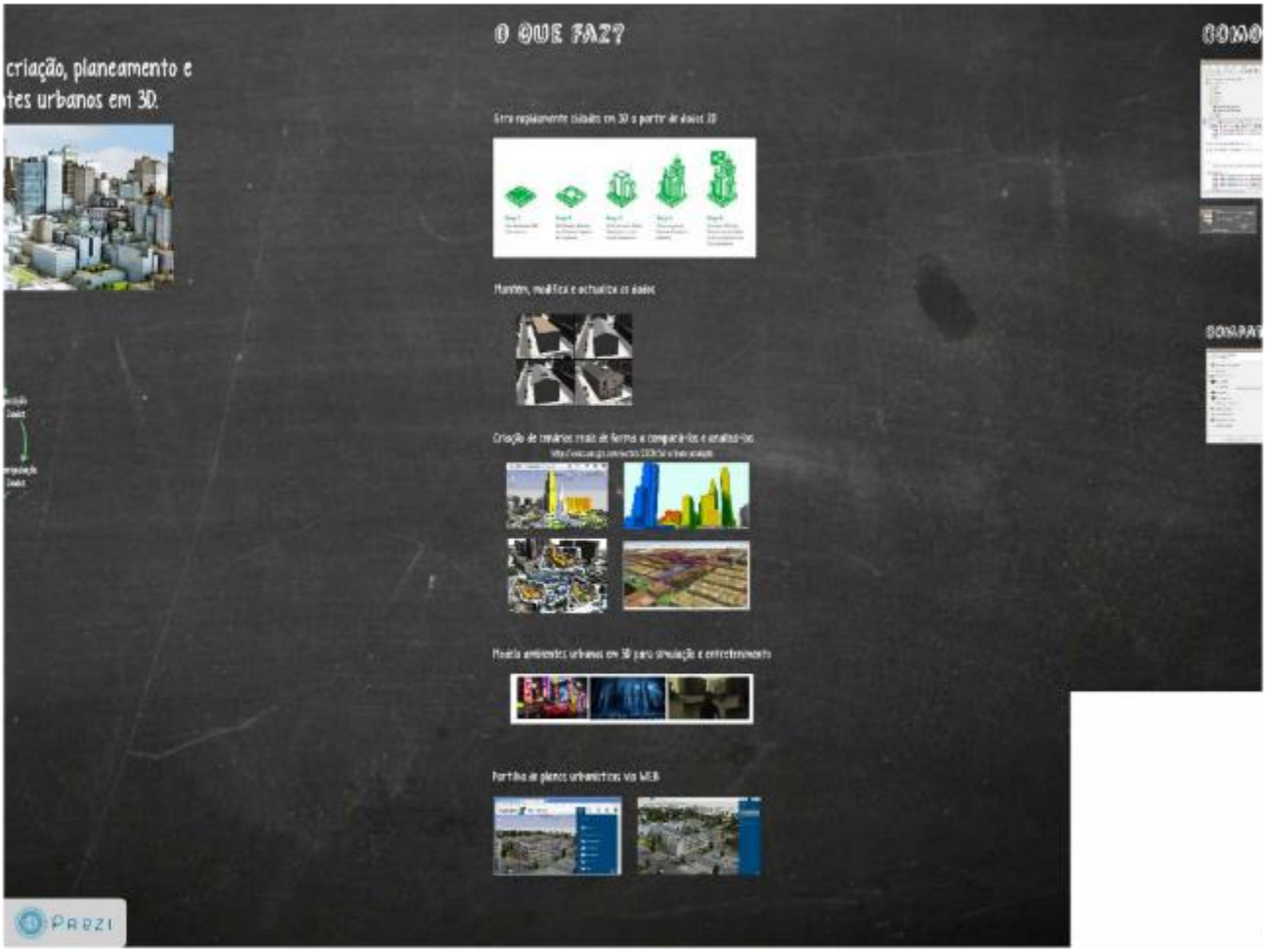
BY RÚBEN REIS

O QUE FAZ?

Um software para a criação, planeamento e
modelação de ambientes urbanos em 3D.

PREZI

Um software para a criação, planeamento e modelação de ambientes urbanos em 3D.

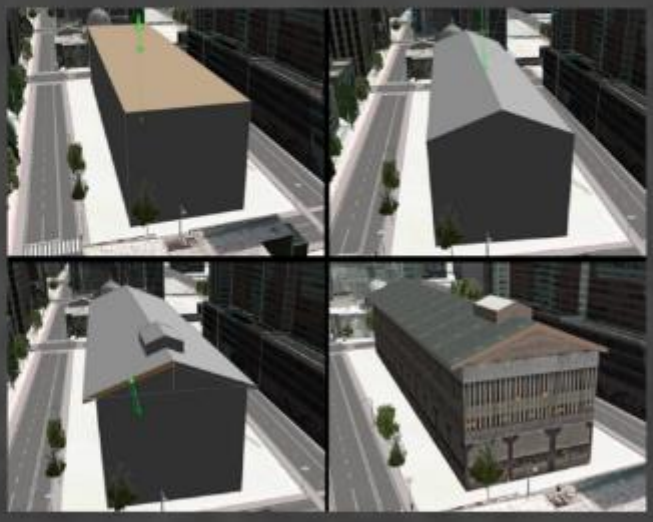

criação, planeamento e
tes urbanos em 3D.
O QUE FAZ?
Gera rapidamente cidades em 3D a partir de dados 2D
Mantém, modifica e actualiza os dados
Criação de cenários reais de forma a comparar-los e analisar-los
Planeia ambientes urbanos em 3D para simulação e entretenimento
Partilha de planos urbanísticos via WEB
COMO
COMPAT
PARZI


O QUE FAZ?
PARZI

Gera rapidamente cidades em 3D a partir de dados 2D

Mantém, modifica e actualiza os dados

Mantém, modifica e actualiza os dados



Prezi

Criação de cenários reais de forma a compará-los e analisá-los

http://video.arcgis.com/watch/2208/3d-urban-analysis

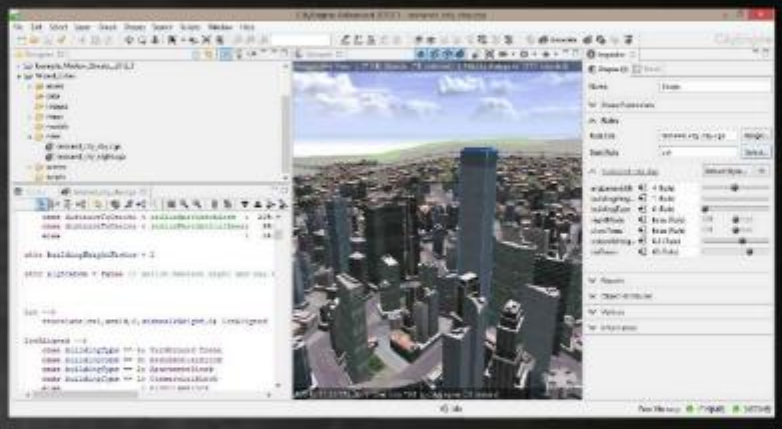
Modela ambientes urbanos em 3D para simulação e entretenimento

Partilha de planos urbanísticos via WEB

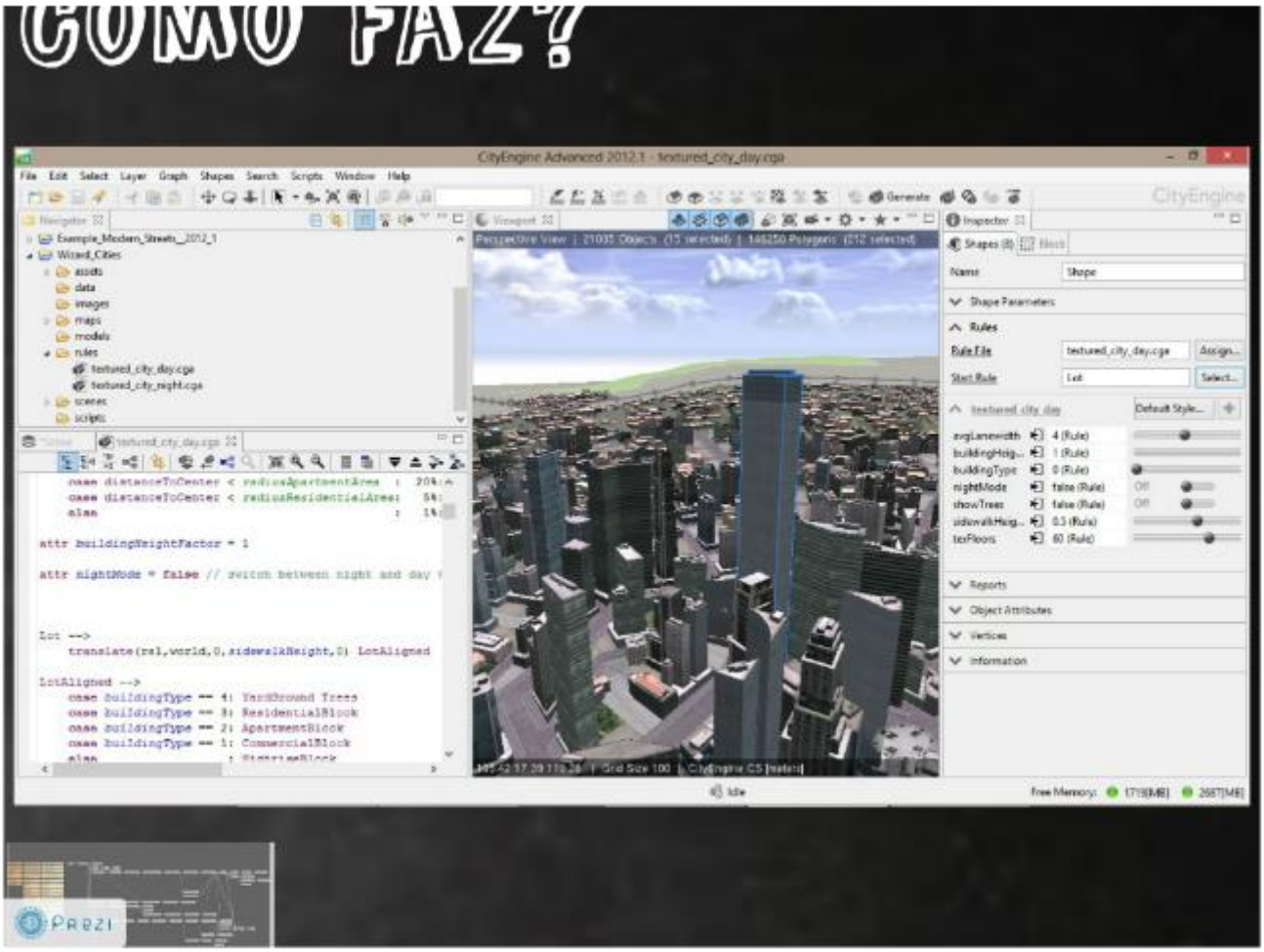
Partilha de planos urbanísticos via WEB

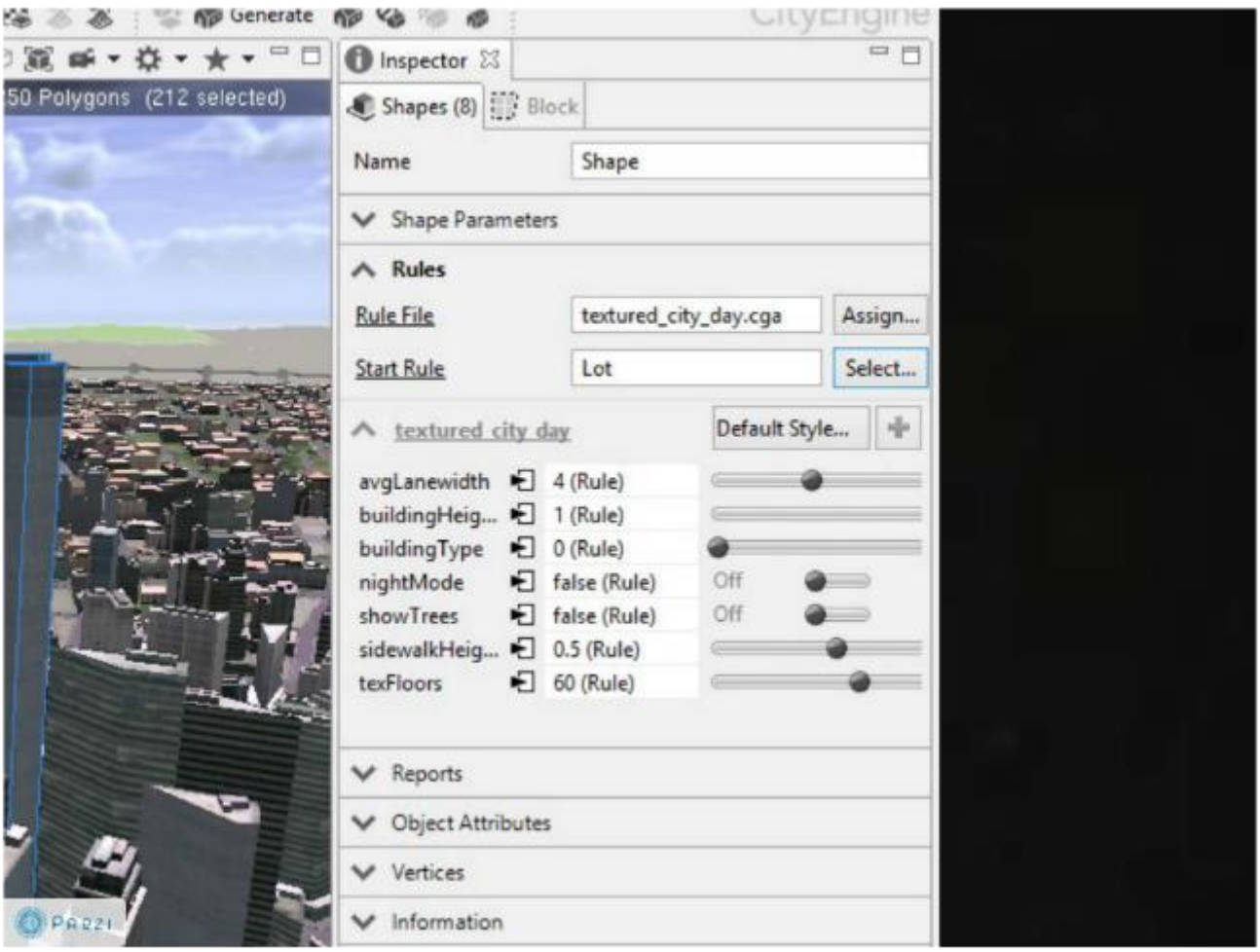
PARZI

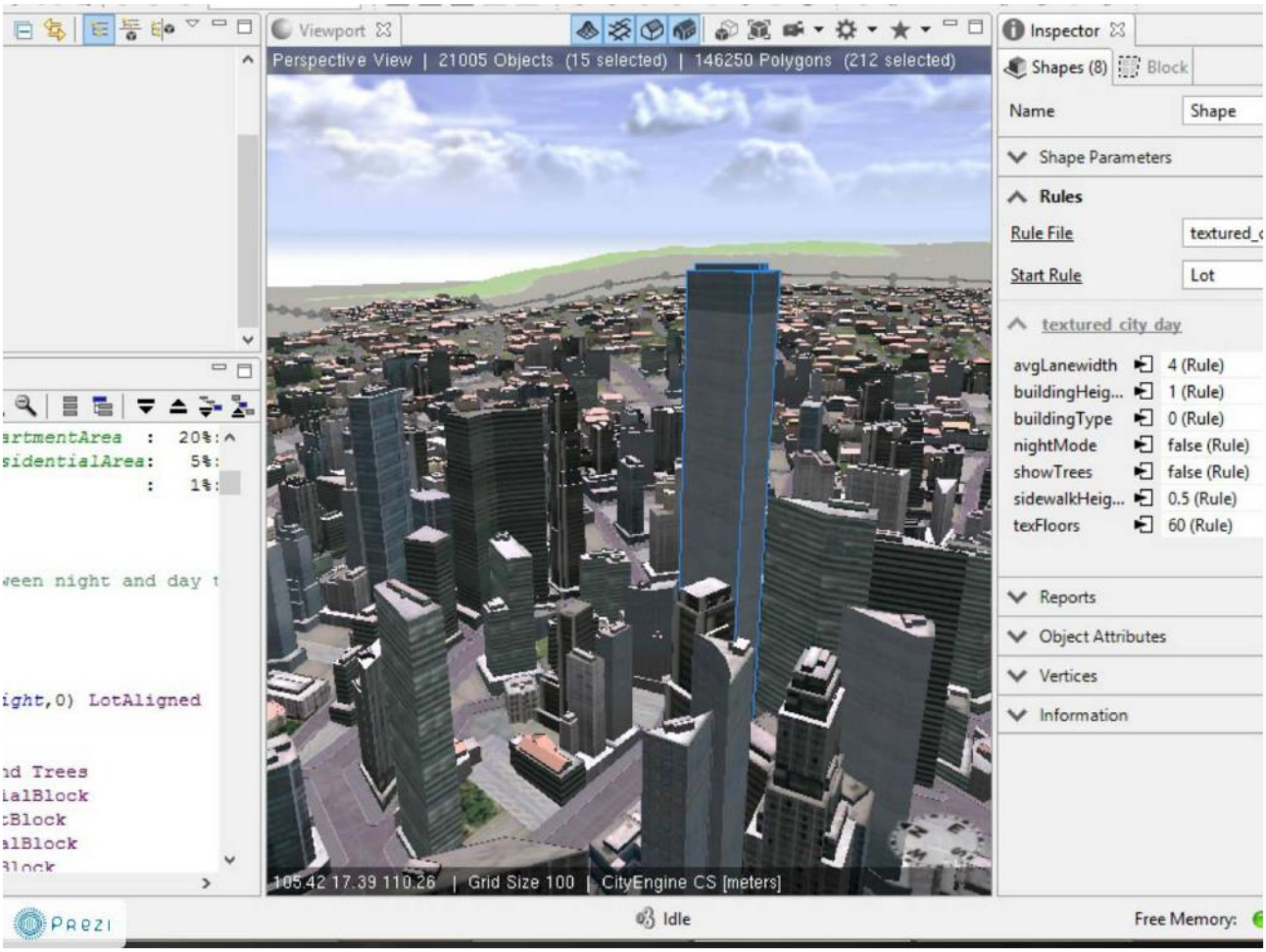
COMO FAZ?

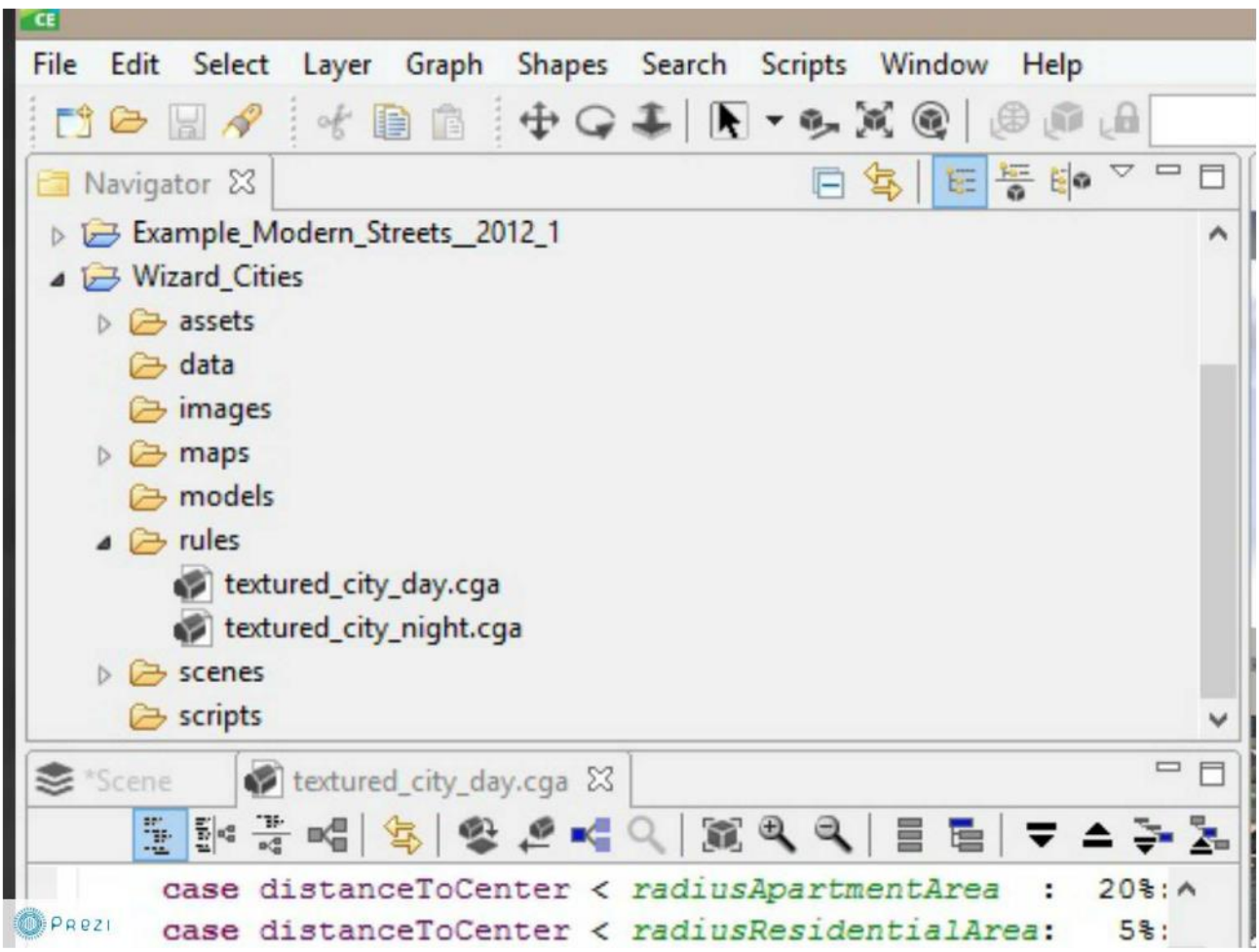


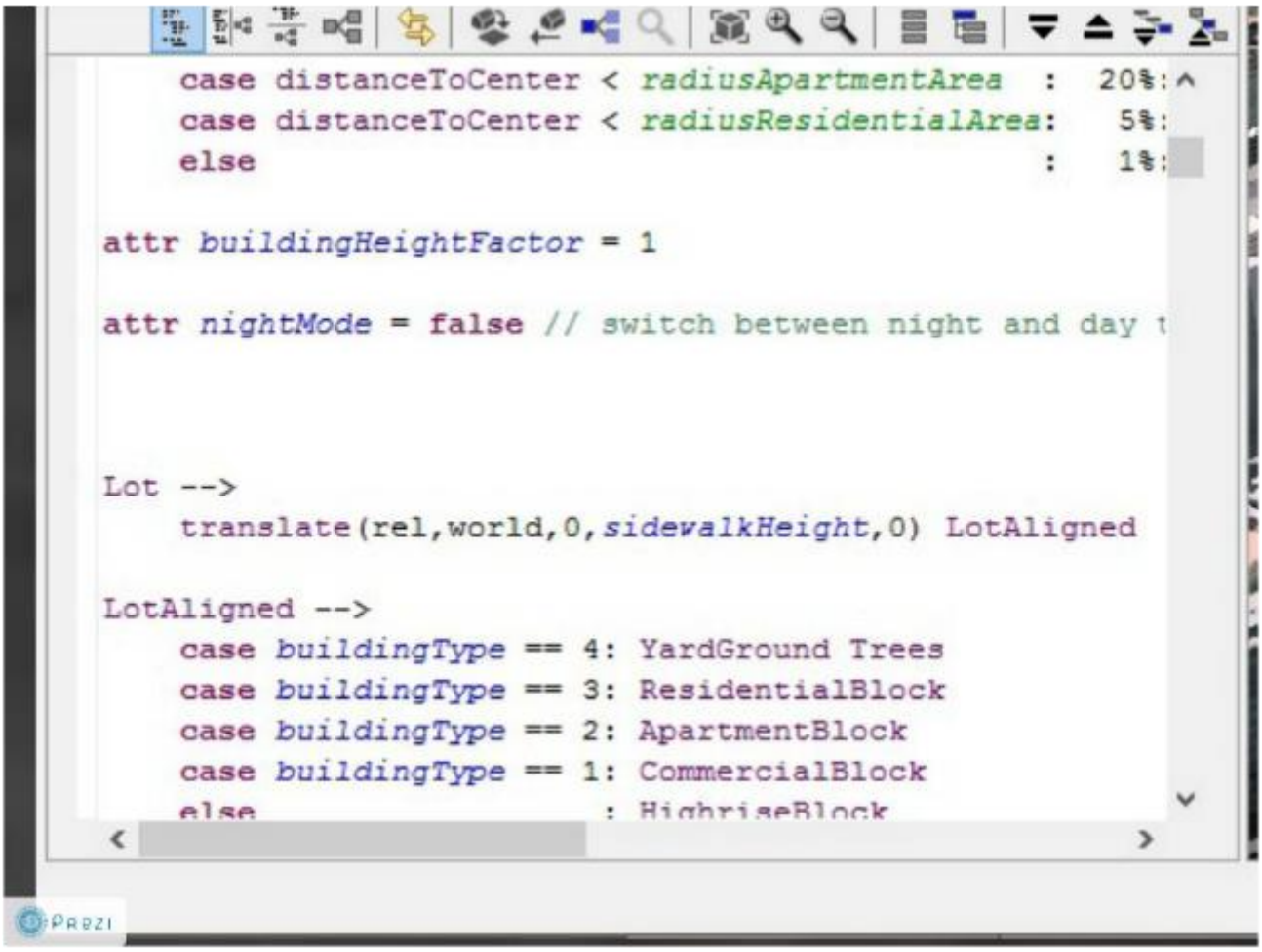
PARZI

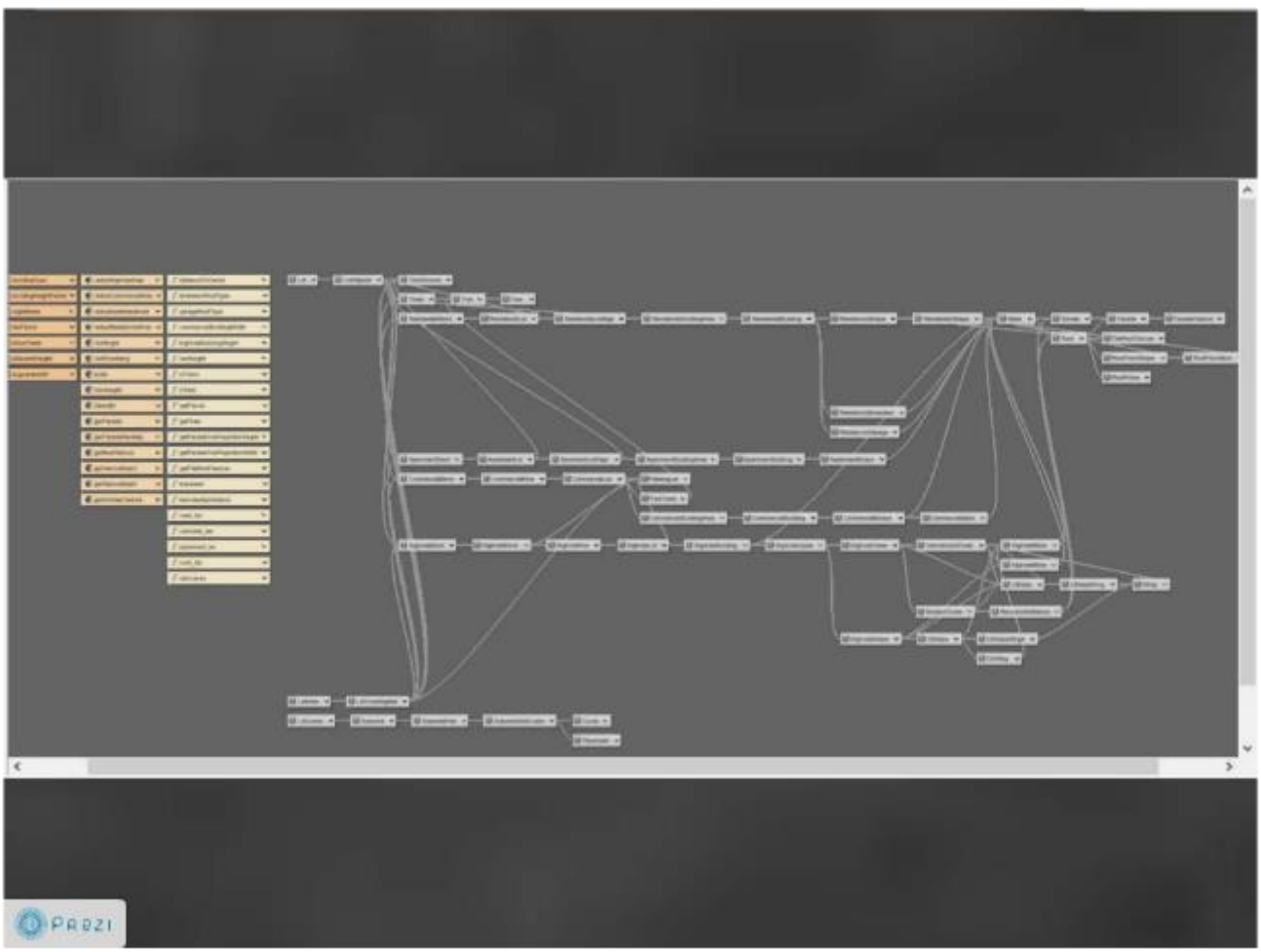

COMO FAZ?
CityEngine Advanced 2012.1 - textured_city_day.cga
File Edit Select Layer Graph Shapes Search Scripts Window Help
Example_Modern_Streets_2012_1
Wizard_Cities
assets
data
images
maps
models
rules
textured_city_day.cga
textured_city_night.cga
scenes
scripts
attr buildingHeightFactor = 1
attr nightMode = false // switch between night and day
Lot -->
translate(rel,world,0,sidewalkHeight,0) LotAligned
LotAligned -->
case buildingType == 4: TerrGround Trees
case buildingType == 3: ResidentialBlock
case buildingType == 2: ApartmentBlock
case buildingType == 1: CommercialBlock
Inspector
Shapes (8)
Block
Name
Shape
Shape Parameters
Rules
Rule File
textured_city_day.cga
Assign...
Start Rule
Lot
Select...
textured_city_day
Default Style...
avgLanewidth 4 (Rule)
buildingHeig... 1 (Rule)
buildingType 0 (Rule)
nightMode false (Rule)
showTrees false (Rule)
sidewalkHeig... 0.5 (Rule)
texFloors 60 (Rule)
Reports
Object Attributes
Vertices
Information
Idle
Free Memory:
PARZI


Generate
CityEngine
50 Polygons (212 selected)
Inspector
Shapes (8)
Block
Name
Shape
Shape Parameters
Rules
Rule File
textured_city_day.cga
Assign...
Start Rule
Lot
Select...
textured_city_day
Default Style...
avgLanewidth 4 (Rule)
buildingHeig... 1 (Rule)
buildingType 0 (Rule)
nightMode false (Rule)
Off
showTrees false (Rule)
Off
sidewalkHeig... 0.5 (Rule)
texFloors 60 (Rule)
Reports
Object Attributes
Vertices
Information
PARZI


Viewport
Perspective View | 21005 Objects (15 selected) | 146250 Polygons (212 selected)
105.42 17.39 110.26 | Grid Size 100 | CityEngine CS [meters]
Inspector
Shapes (8)
Block
Name
Shape
Shape Parameters
Rules
Rule File
Start Rule
Lot
textured_city_day
avgLanewidth 4 (Rule)
buildingHeig... 1 (Rule)
buildingType 0 (Rule)
nightMode false (Rule)
showTrees false (Rule)
sidewalkHeig... 0.5 (Rule)
texFloors 60 (Rule)
Reports
Object Attributes
Vertices
Information
Idle
Free Memory:
PREZI


CE
File Edit Select Layer Graph Shapes Search Scripts Window Help
Navigator
Example_Modern_Streets__2012_1
Wizard_Cities
assets
data
images
maps
models
rules
textured_city_day.cga
textured_city_night.cga
scenes
scripts
*Scene
textured_city_day.cga
case distanceToCenter < radiusApartmentArea : 20%:
case distanceToCenter < radiusResidentialArea: 5%:
PREZI


case distanceToCenter < radiusApartmentArea : 20%:
case distanceToCenter < radiusResidentialArea: 5%:
else : 1%:
attr buildingHeightFactor = 1
attr nightMode = false // switch between night and day t
Lot -->
translate(rel,world,0,sidewalkHeight,0) LotAligned
LotAligned -->
case buildingType == 4: YardGround Trees
case buildingType == 3: ResidentialBlock
case buildingType == 2: ApartmentBlock
case buildingType == 1: CommercialBlock
else : HighriseBlock
PREZI


PREZI

COMPATIBILIDADES

ArcGis
AutoCAD
Maya
3DsutioMAX
Revit
...

PREZI

CITYENGINE

UMA NOVA PERSPECTIVA PARA O PLANEAMENTO URBANO

BY RÚBEN REIS

O QUE FAZ?

Um software para a criação, planeamento e
visualização de ambientes urbanos em 3D.

Desenvolvimento de Apps para arquitetura

Pedro Faria Lopes

Developing Apps for Architecture

Pedro Faria Lopes
ISCTE-IUL, ADETTI-IUL, ISTAR-IUL

Econtro "Gramáticas de Forma para Transformação Urbana"
2014-04-11

Index

- Three Apps
  - Defining the nuclear family cell, [(near)illiterate]
    - Emerg.cities4all project
  - Behavior observation by counting
    - Lisbon Pedestrian Network project
    - Close to cities and closer to people project
  - App | Automatic Housing Functional Programme
    - Prof. Sara Eloy's PhD follow up project
- Lessons learned
- Conclusions

App 1

- Defining the nuclear family cell, [(near)illiterate]
  - Emerg.cities4all project
- Specification
  - P.F. Lopes, S. Eloy, R. Guerreiro
- Students, LEI, 3rd year, 2011-2012
  - Ana Marta Aparício, nº 33570
  - Fábio Tavares, nº 33575
  - Pedro Barros, nº 33605
  - Sara Guerreiro, nº 34391

Creating an interface

- Current paradigm
  - desktop paradigm
    - folders and files present in a virtual desktop
  - drag&drop, scroll, pop-up windows and menus, pull-down menus and drop-down list menus
- For people with low or no digital user expertise these are barriers: procedures to manipulate, select and input <u>hidden information</u>

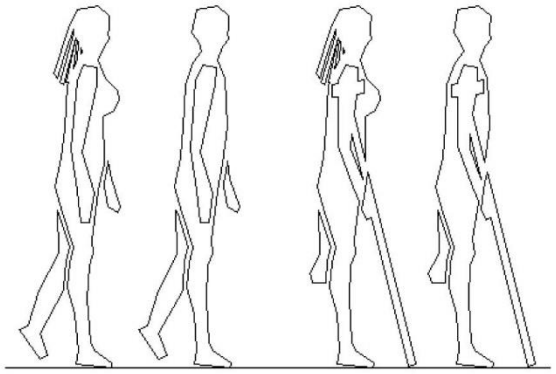
YSWYI

- For users with no digital user expertise:
  You See What You Input (YSWYI) approach
  – Features
    - No hidden information
    - The basic unit is the full screen
    - Input information visually present all the time
      – Minimal information per basic unit to avoid confusion!
    - Information input: successive screens step**by**step
    - YSWYI: simplicity and usability in the real world

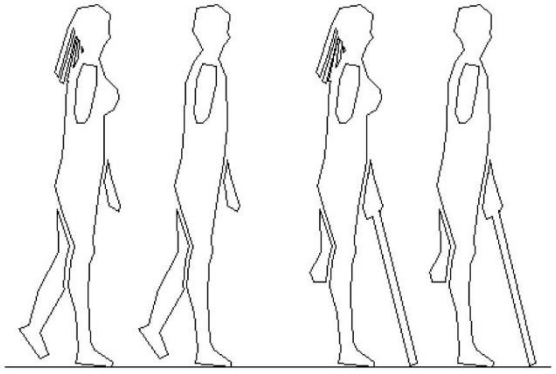
Input icons

- The family unit is composed of parents, children, cousins, aunts, nephews, nieces, grandparents and others (friends, friends of friends, may be still relatives or not)
  – Extended family concept
- Possibility of having amputees in the household
  - Example: Mozambique, +20 people injured/killed by land mines each month (2011 report)

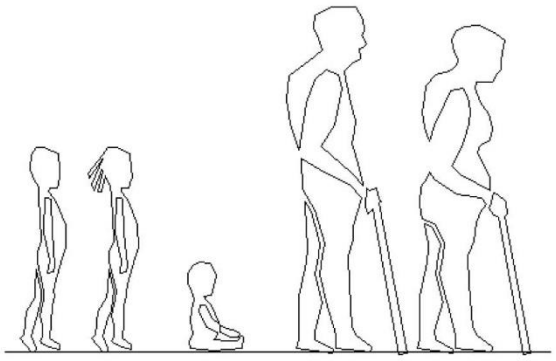
Input icons, study, S. Eloy



Input icons, study, S. Eloy



Input icons, study, S. Eloy



Now & to be done

- Current status of the study
  - Children are also affected by war consequences: child amputee icon?
    - necessary to define the household typology?
- Further steps
  - Icons tests with the target group
  - Creation of a mokup and tests

IPM, group 1

- Next slides: from student's PPT (SPPT)
  - Not edited material, marked with SPPT
- UC: Interacção Pessoa-Máquina 2011-12
  - Students from LEI, 3rd Year
    - Ana Marta Aparício, nº 33570
    - Fábio Tavares, nº 33575
    - Pedro Barros, nº 33605
    - Sara Guerreiro, nº 34391

Contexto do Projecto

SPPT

P.F. Lopes, J. Reis, F. Santos, S. Eloy, A. Paio, V. Rato, *Shaping emergent cities for all*, SIGraDi 2011, XV Congreso de la Sociedad Iberoamericana de Grafica Digital, 16-18 de Novembro 2011, Santa Fé, Argentina, pp. 106-108. ISBN: 978-987-657-679-6

- Levantamento da Família Alargada
- **You See What You Input (YSWYI)**
  - ➢Brasil
  - ➢Angola
  - ➢Moçambique

Forma de desenvolvimento

SPPT

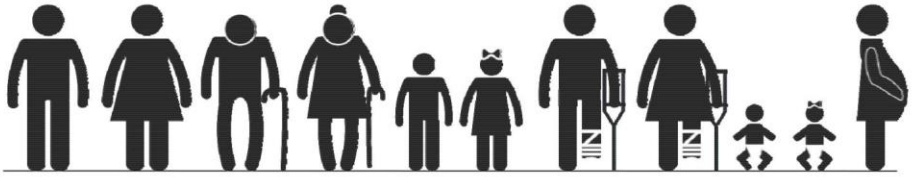
- Não convencional
  - *Loose specs*
  - Ensaio / tentativa / erro
  - Testes iterativos
    - E interactivos
  - Como testar sem o público alvo final?
  - O que são os ícones representativos para o público alvo final?

Ícones, A. Horta

SPPT

1ª Versão

Versão Final



Estudo da Iconografia Regional

SPPT

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Testes

SPPT

Número total: 45 testes + 4 testes preliminares

Categorias

Testes Preliminares: 2 alunos + 2 professores

Testes:

Professores: 7

Alunos : 22

Secretariado: 10

Idosos (> 50 anos): 6

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Testes, Análise Qualitativa

SPPT

- Observadores: Notou-se que num dos testes a presença de 4 observadores se transformou num factor de stress significativo
- Tipos de Ícones: Algumas das pessoas, nos ícones da família, estranhavam os ícones "desaparecerem" de ecrã para ecrã – noção de conjunto
- Uso da barra de navegação para inserir ícones: nos testes preliminares esta funcionalidade foi pedida e mostrou-se muito utilizada nos testes posteriores
- Mesmo pessoas idosas *computerfóbicas*/tecnofóbicas interagiam com o dispositivo porque não é um computador
  - Leitura de que o dispositivo *é como* um jogo
- "Já estou a fazer asneira" – não é a pessoa a ser avaliada, mas o sistema

Dificuldades, aprendizagem

SPPT

- Como testar sem o público alvo
  - Africanos rurais sem escolaridade ou modernidade
  - Europeus: ou muito velhos ou muito novos
  - Temas: possibilidade de usar cores, flores, brinquedos, compras, como temas de teste fora do público alvo
- Que ícone para *disabled person* com público alvo que não conhece "cadeira de rodas"?
- Sair da zona de conforto: o que é não saber?

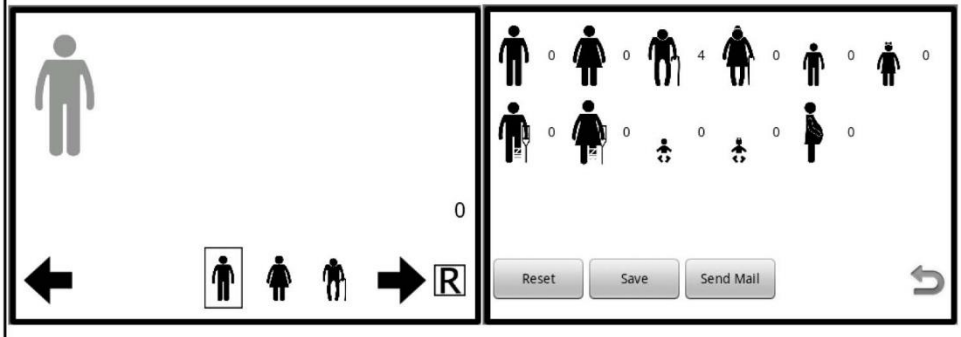
Algumas conclusões

SPPT

- Não é fácil vestir a pele do outro
  - Especialmente quando se trata de "não saber"
  - O que nos parece evidente NÃO é evidente
- Dependendo do *background* do testador (uso de *touch screen – Android, iPhone*) mais ou menos imediatismo na interacção
  - Exemplo: aluno de MIA, apagar um elemento, tocar
    - Porquê? "Porque era a única possibilidade!"

Exemplo

SPPT



SPPT

Vídeo, demo

App 2

- Behavior observation by counting
  - Lisbon Pedestrian Network project
  - Close to cities and closer to people project
- Specification
  - P.F. Lopes, S. Eloy
- Students, LEI, 3rd year, 2012-2013
  - Tiago Martins
  - Marco Menino
  - João Caldas
  - Flávio Freire

Context

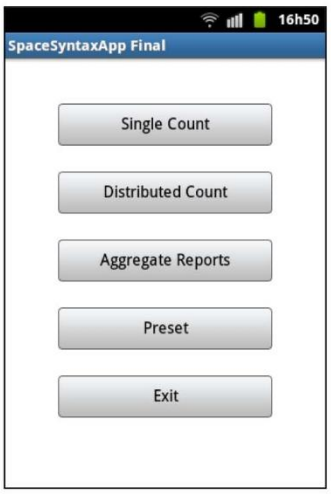
- Settings
  - Define a virtual gate
  - Define the items to process
  - Count the items that traverse the virtual gate
  - Directly applicable in Space Syntax contexts
  - User configurable to add any items at will

The App

- Android App
- Developed in Human-Computer Interaction (HCI) Curricular Unit
- Targeted (initially) for Architects, usable by anyone
- Tested with Architects and Architecture students
- Participatory and iterative
  - Specification, design, testing, implementation, testing

Main functions

- **Single Count** and **Distributed Count**
- Automatic reports
- **Aggregate Reports**
- User configurations for later use



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Single Count 1/2

- Enables the user to start counting in a very fast way after selecting **Local Name** and **Gate Name**, the **Time** interval and …

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Single Count 2/2

- … the **items** to be counted.

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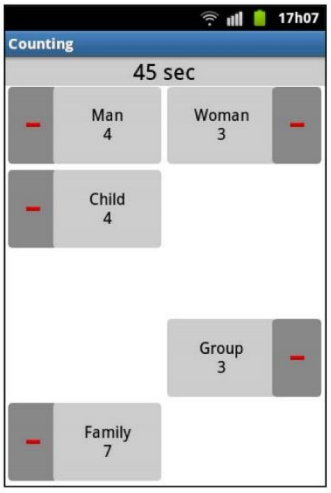
Counting layout

- … or a **Custom Pick** layout.
- Counting (increase and decrease) has an immediate non visual feedback: vibration, reassuring the user on the correct entry



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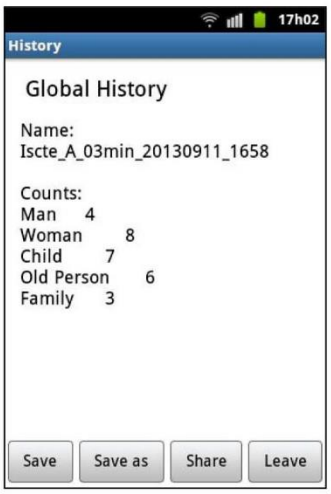
Reports

- Each count generates a **Report**.
- Multiple reports can be aggregated into an integrated report.
- Reports are in **CSV** text format (**C**omma **S**eparated **V**alues)
  - Spreadsheet ready

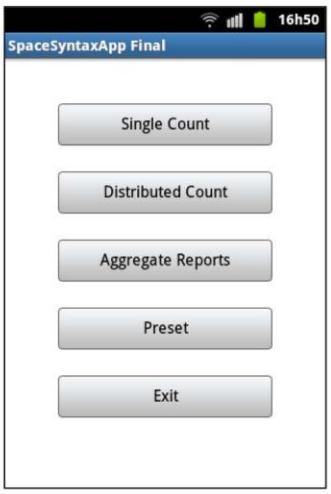


Preset

- A phone call can ruin a count: the **Airplane Mode** avoids calls.
- Broad day light affects readability: the **Application Brightness** control is available.
- A freshly fully charged battery is advised.

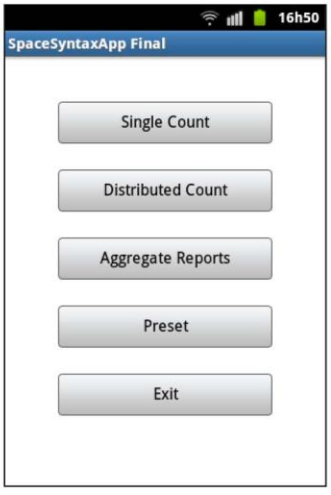
Testimonial

- Nádia Romão, MSc Architecture student: "The app is very useful, easy to use and much better than using a sheet of paper. The reports also eased the work, enabling me to create graphics with no need to introduce the counts one by one".



Final remarks

- Full battery is advised
- Calls do ruin counting
  - As with pencil/paper
- Sun glare, a problem
  - Choose the right spot
- Vibration feedback very useful: no looking down
- CSV text reports direct use
- 4 months, +5000 code lines



App 3

- App | Automatic Housing Functional Programme
  - Prof. Sara Eloy's PhD follow up project
- Specification
  - S. Eloy, P.F. Lopes
- Students, LEI, 3rd year, 2013-2014
  - David Paiva
  - Filipe Martins
  - João Paulino
  - Rúdi Luis

IPM, group 1

- Next slides: from student's PPT (SPPT)
  - Not edited material, marked with SPPT
- Week 8 of classes (total of 9 weeks)
- UC: Interacção Pessoa-Máquina 2013-14

Evolução do programa

SPPT

- Alteração da tabela, para melhor acesso aos dados;
- Finalização dos layouts do programa;
- Realização de pequenos testes.

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Mini Testes

SPPT

Participante	Idade	Escolaridade	Font Size	Iniciar App	Sobre	Ajuda	Idioma	SmartPhone?
1	36	12	+	+-	-	+	+	N
2	47	9	+	+	-	+	+	N
3	49	4	+	+	-	+	+-	N
4	33	12	+	+	-	+	+	N
5	28	licenciatura	+	+	+	+	+	S
6	20	12	+	+	+	+	+	N
7	21	12	+	+	+	+	+	N
8	22	12	+	+	+	+	+	S
9	22	12	+	+	-	-	-	N
10	21	12	+	+	+	+	+	S
11	20	12	+	+	+	+	+	S
12	32	licenciatura	+	+	+	+	+	S

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Alteração dos layouts

SPPT

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Alteração dos layouts

SPPT

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Alteração dos layouts

SPPT

Alteração dos layouts

SPPT

IPM1314 Gr01 Week 7-8-9

SPPT

	13-Feb-2014 - 27-Mar-2014	27-Mar-2014 - 24-Abr-2014
	O que fez?	O que vai fazer?
David Paiva	Alteração da tabela; Produção do output do programa; Realização de alguns testes.	Continuação da produção do output.
Filipe Martins	Finalização dos layouts; Alteração da tabela; Realização de alguns testes.	Elaboração do guião de testes.
João Paulino	Alteração da tabela; Realização de alguns testes.	Elaboração do guião de testes.
Rudi Luis	Alteração da tabela; Produção do output do programa; Realização de alguns testes.	Continuação da produção do output.

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Lessons learned

- LEI student mostly follow their heart
- Even when the discourse is/seems coherent …
  - Thoughts and sentences apparently user centered
- … the practice shows otherwise
  - Students tests practice is usually unintentionally biased
  - The corridor test
    - » Informal tests with anyone passing in the corridor
    - » Confirms biased previous students tests
- It's a Maturity issue
- App 1, Defining the nuclear family cell, [(near)illiterate]
  - Sara Guerreiro, LEI student but Psychologist
  - It affected the project result in a huge positive way

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Conclusions

- Development for the target user, changed to
- Development for and with the target user
  - Extensive, regular and iterative tests
- Major difficulties
  - 3rd year LEI students tend to be
    - » Engineering centered, programming centered instead of
    - » Target user centered
  - Good results depend heavily on close monitoring of
    - » Specification
    - » Weakly work done
    - » Tests results with users