

ROSA CORSTJENS

ANDERS BOUWER

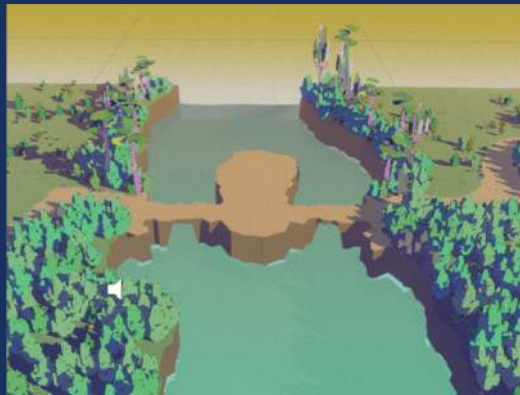
JORIS DORMANS

RIEMER VAN ROZEN

# WONDERFUL DESIGN

## APPLYING APPRAISAL THEORY TO PROCEDURAL LEVEL GENERATION

AMSTERDAM UNIVERSITY OF APPLIED SCIENCES, LUDOMOTION, CWI



EXAG18 - 14 NOVEMBER 2018

# AGENDA

- Context, Problem & Research Questions
- Theories of Emotion
- Affecting Emotions using Appraisal Theory
- Design Patterns in Generative Grammars
- Discussion & Conclusions

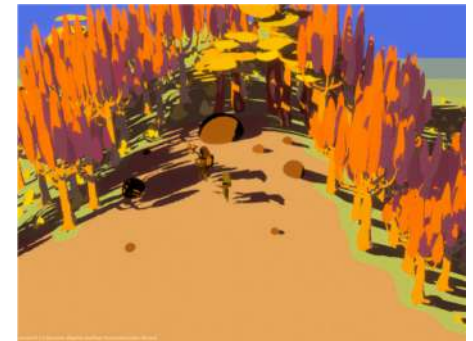
# CONTEXT

## Project Live Game Design

- Amsterdam University of Applied Sciences
- Goal: Intelligent tools for Game Designers



- Case study:
  - Ludomotion
  - Game: The Sequel to Unexplored



# PROBLEM STATEMENT

***Lack of abstractions and tools for directing generation and affecting emotions***

# RESEARCH QUESTIONS

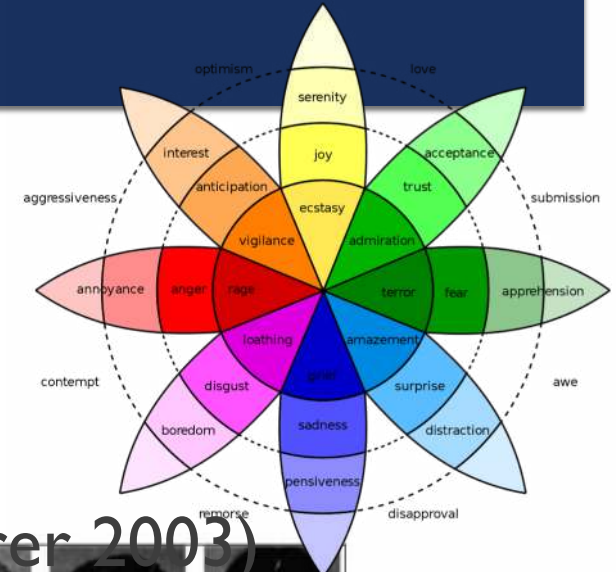
*How can Theories of Emotion be used to create design patterns for affecting emotions?*

# RESEARCH QUESTIONS

*And how can these be implemented using generative grammars for procedural level generation?*

# THEORIES OF EMOTION

- Dimensional (Plutchik 2001)
- Categorical (Ekman 1992)
- Appraisal theory (Smith & Lazarus 1990, Ellsworth & Scherer 2003)



# APPRAISAL THEORY

- Thesis: multiple appraisals → emotion

Table 29.2 Examples of Theoretically Postulated Appraisal Profiles for Different Emotions

Appraisal Criteria	Joy/Happiness	Anger/Rage	Fear/Panic	Sadness
Novelty	high	high	high	low
Intrinsic pleasantness	high	open	low	open
Goal significance				
Outcome probability/certainty	high	very high	high	very high
Conduciveness/consistency	conductive	obstructive	obstructive	obstructive
Urgency	low	high	very high	low
Coping Potential				
Agency/responsibility	self/other	other	other/nature	open
Control	high	high	open	very low
Power	high	high	very low	very low
Adjustment	high	high	low	medium
Compatibility with standards/ value relevance/legitimacy	high	low	open	open

Ellsworth & Scherer, 2003



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Ellsworth & Scherer, 2003

# OUR APPROACH

- **Pattern extraction**
- Pattern formulation
- Implementation in generative grammars



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## PATTERN - JUST NOT SYMMETRIC



**Problem** How can placement of objects trigger unpleasantness and obstructiveness in the player?

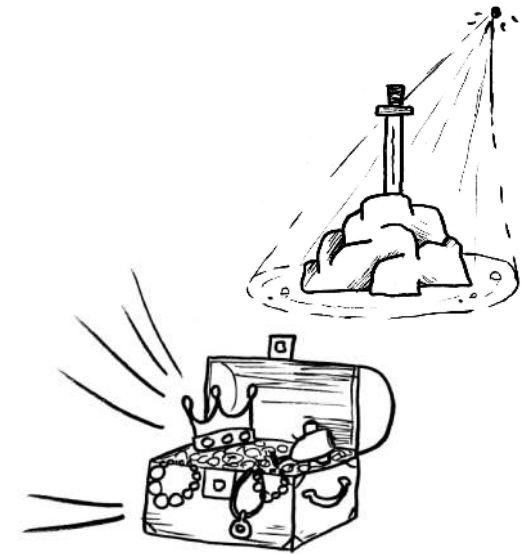
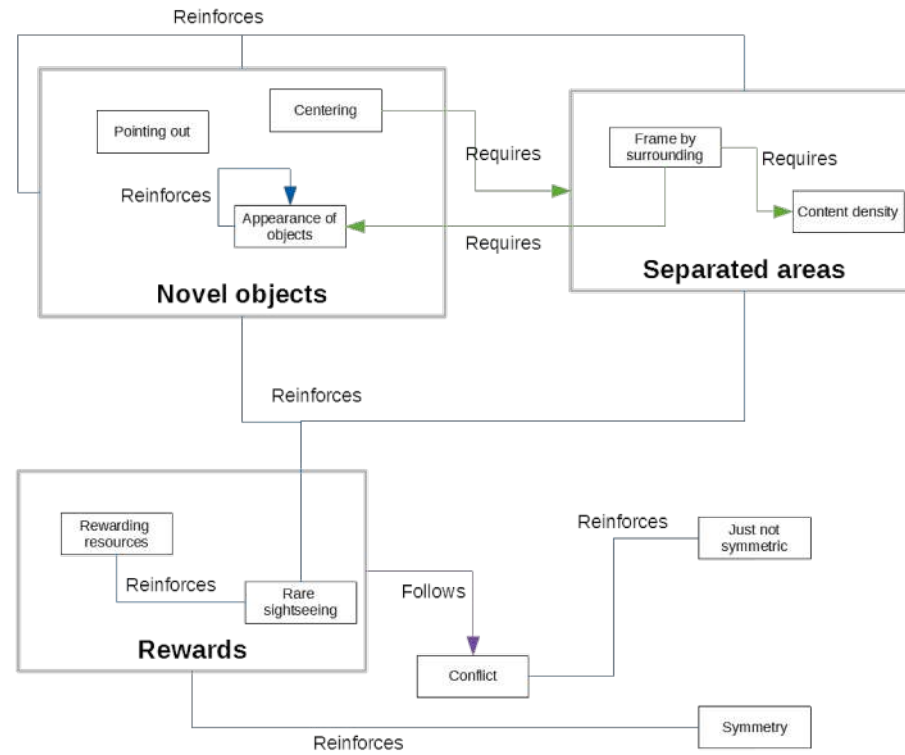
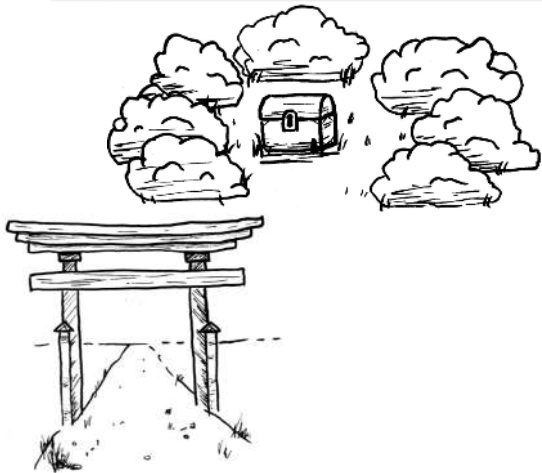
- Forces**
- The **placement symmetry** refers to the placement of objects. Perfect placement symmetry indicates that all objects on one side are placed on exactly the same location as their counterparts on the other side. Small differences will still make the player perceive the scene as symmetric.
  - The **object symmetry** refers to the objects making up the symmetry. Perfect object symmetry uses exactly the same objects on both sides of the symmetry, but also to differences in those objects will still enable perceiving the scene as symmetric.
  - The **degree of symmetry** arises from both placement and object symmetry, but also to extra noise added to the scene. A perfect degree of symmetry does not include noise and has perfect placement and object symmetry. When a bit of noise is added by placing small objects randomly or when the placement or object symmetry are not perfect, the degree of symmetry can still be high enough for the player to perceive it as symmetrical. Whenever more notable noise is added or greater differences are made in either the placement or object symmetry the perception of symmetry is lost quickly.
  - Patterns triggering unpleasantness **inhibit** emotions that require pleasantness or the absence of unpleasantness.
  - Patterns triggering obstructiveness **inhibit** emotions that require conduciveness or the absence of obstructiveness.

**Context** You are designing a level and a particular location should trigger unpleasantness and obstructiveness in the player.

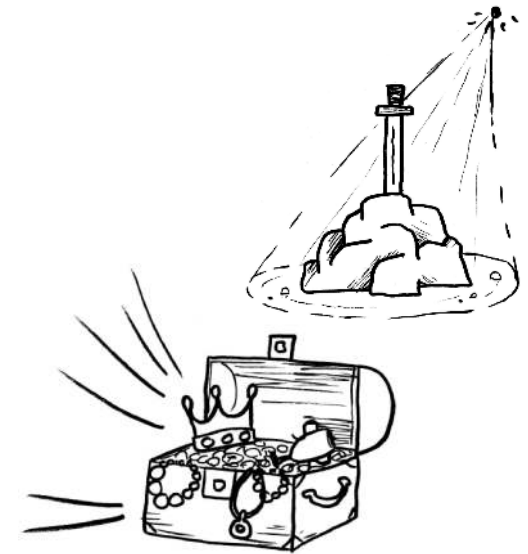
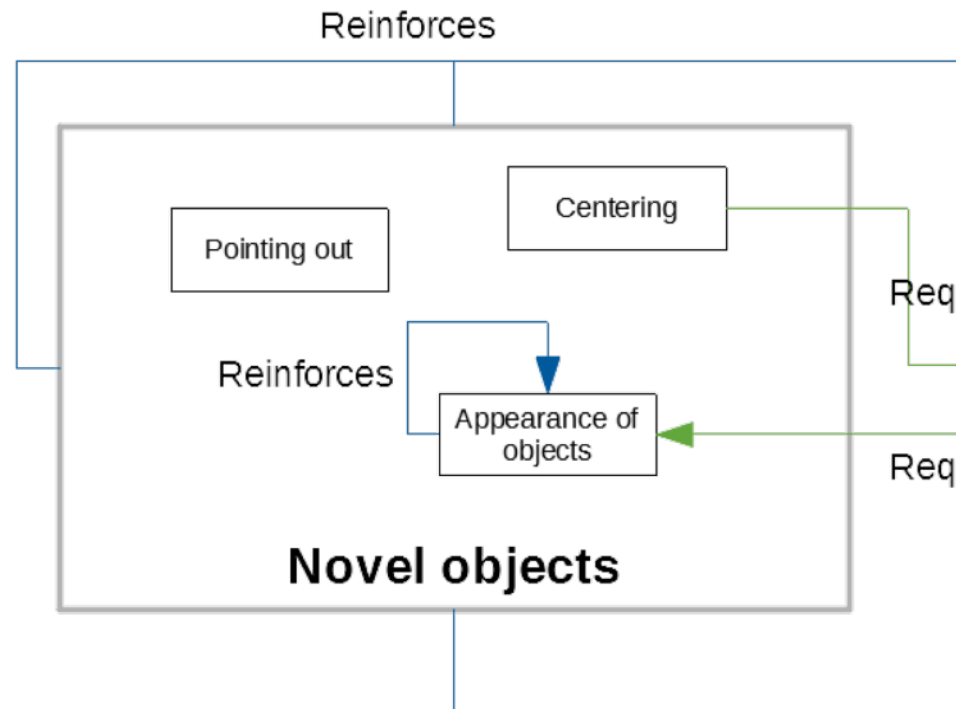
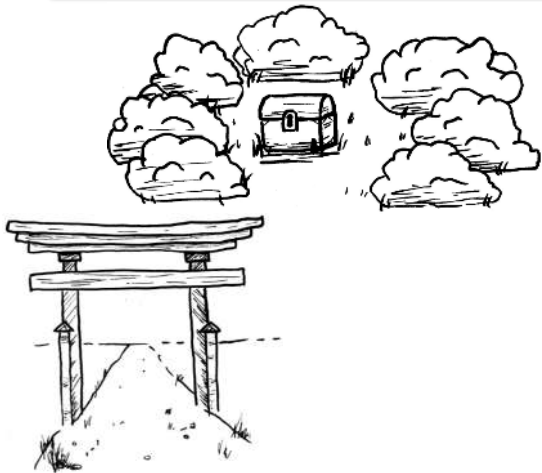
- **Placement symmetry:** either placement or object symmetry should be off, although both must still communicate a sense of symmetry.
- **Object symmetry:** either placement or object symmetry should be off, although both must still communicate a sense of symmetry.
- **Degree of symmetry:** the player must notice that a possibility for symmetry exists in the area of interest, but no real symmetry should exist. Meaning that placement or object symmetry should be off and additionally some noise can be added. When the player is able to notice the possibility for symmetry, but can never find it, the area feels off and can trigger a similar feeling to that of the *Uncanny Valley*. A concrete minimum and maximum degree of symmetry required to reach the desired effect is not defined: testing and tweaking will provide the best results.

- Participants**
- The location: the location in which objects are placed just not symmetric.
  - The objects: the objects that are placed in the location.

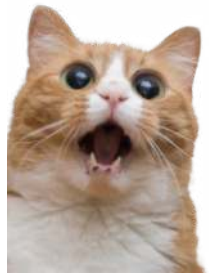
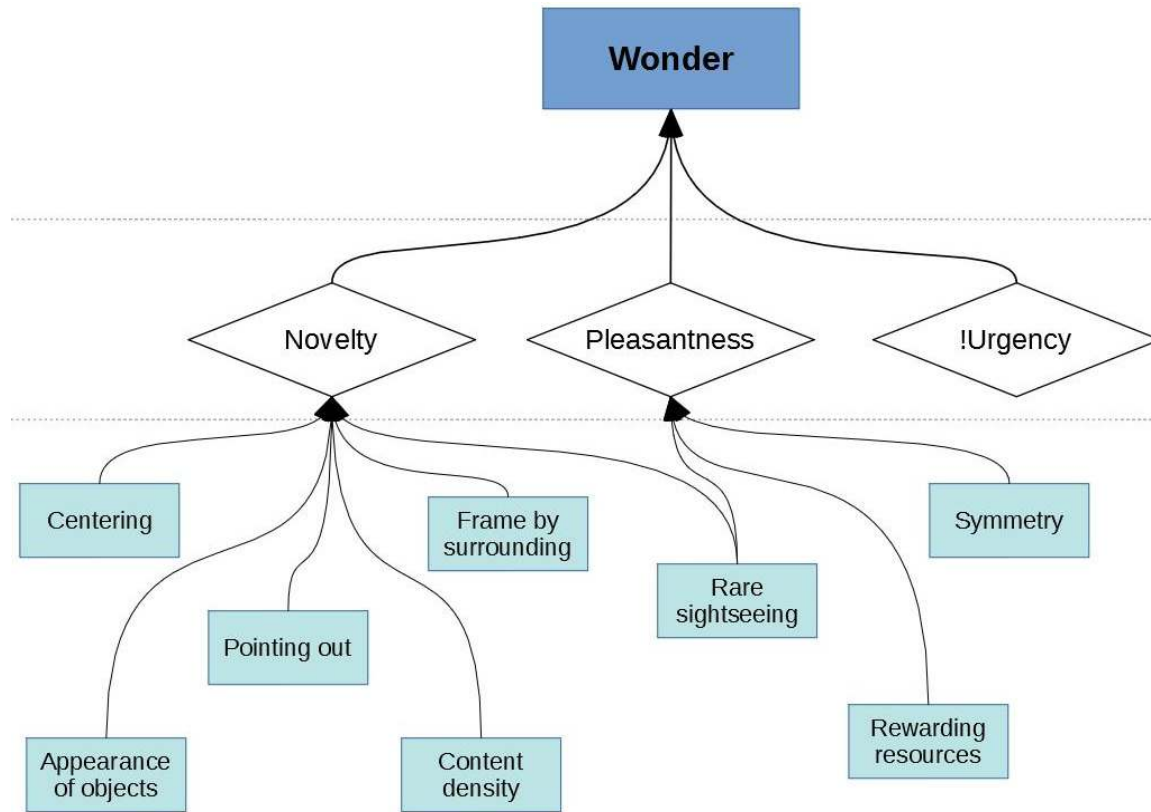
# APPRAISAL PATTERNS



# APPRAISAL PATTERNS



# EMOTION PATTERNS



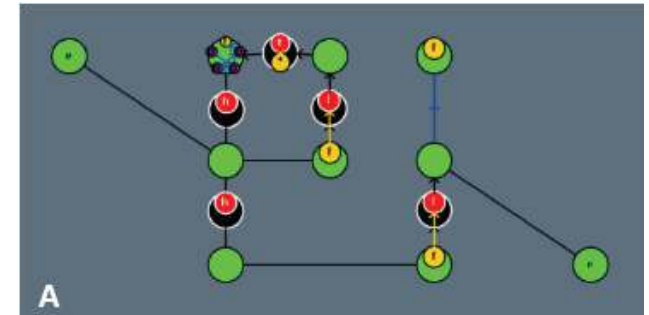
# OUR APPROACH

- Pattern extraction
- Pattern formulation
- **Implementation in generative grammars**



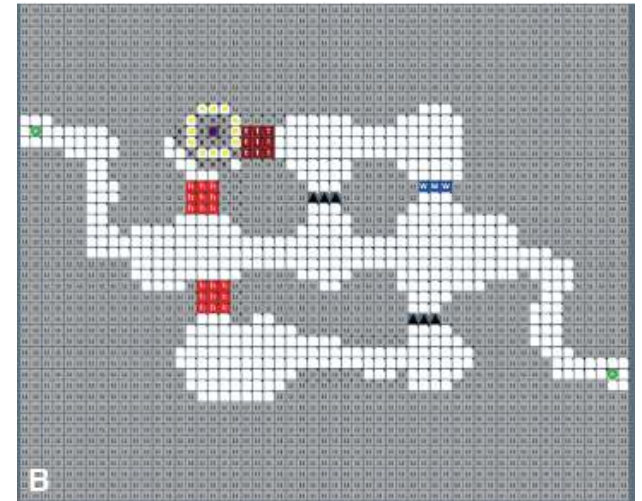
# PATTERN IMPLEMENTATION

1. Define pattern and relations in graph
2. Structure and position in tile map
3. Concretize terminal symbols



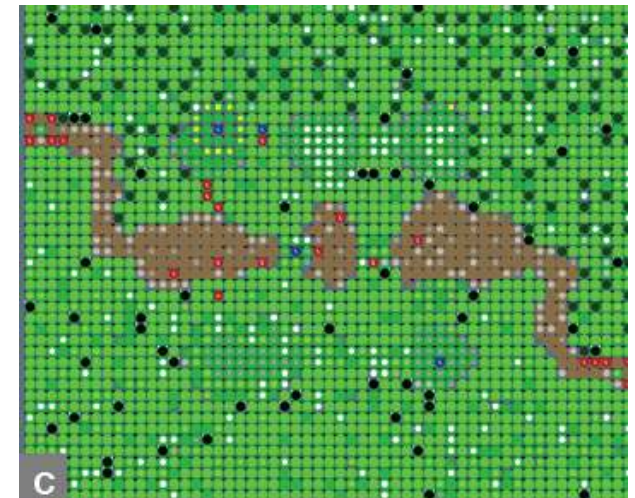
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1. Define pattern and relations in graph
2. Structure and position in tile map
3. **Concretize terminal symbols**



# PATTERN IMPLEMENTATION

The screenshot displays a software development environment with a menu bar (File, Generation, Registers, Random, View, Help) and a toolbar (Alp, Mod, Chk, Txt, →). A window titled "RegistersForm" is open, showing a table of registers and their values.

Register	Value
width	11
height	9
requests	["screy", "wonder"]
setRequests	false
requestedStructure	["cicle", "cycle"]
themes	["biking", "forest"]
used	[]
terranA	["forest", "high"]
terranB	["bushes", "halfLow"]
terranC	["forest"]
terranD	["bushes"]
terranE	["bushes"]
terranF	["bushes"]
elevation	5
entrance	"west"
barrierX	8
specialEntrances	[]
centerX	5
skipe	1
repeatBridgeForm	true
bridge	0
underBridgeForm	---
bridgeForm	---
containsBarrier	false
relatedTileAmount	0
relatedTileOfThisStructure	n

Below the table are buttons: Set, Increment, Decrement, Multiply, Fill, Add, Remove, Remove All, and Close.

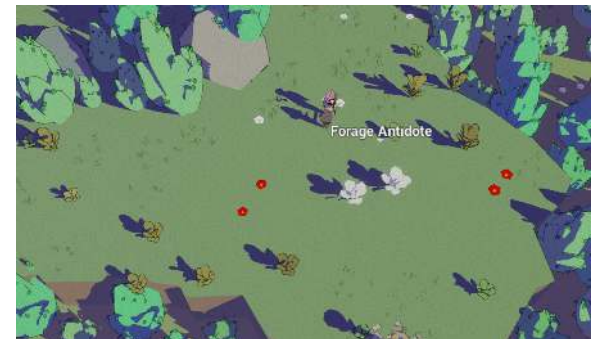
To the right of the RegisterForm window is a state transition diagram. It consists of numerous circular nodes connected by arrows, representing the state space of the system. The nodes are labeled with actions such as "DoRequests", "DecorateRegions", "PrepareTerrainTypeRecupe", "PrepareDiacellRecupe", "PrepareContentRecupe", "AddBarriers", "CombineTerrains", "DoWater", "DoBridges", "Recombine", "DoDecoration", "setSpawLocations", "DoRoads", "SendTerrain", "NewLandscape", "AddFeatures", "AddPieces", "NewLandscape", "PrepareTerrainTypeRecupe", "DoRequests", "DecorateRegions", "PrepareDiacellRecupe", "PrepareContentRecupe", "AddBarriers", "CombineTerrains", "DoWater", "DoBridges", "Recombine", "DoDecoration", "setSpawLocations", "DoRoads", "SendTerrain".

At the bottom of the window, there is a "System" section with buttons: Reset, Iterate, Execute, and Stop. Below these buttons, it says "All systems go".



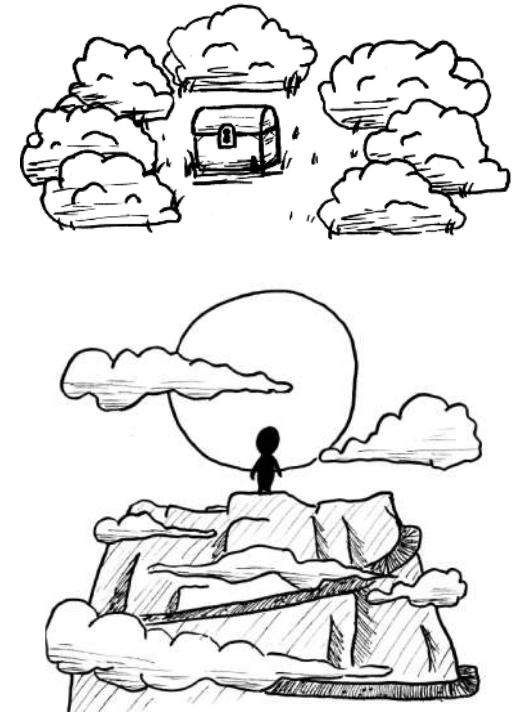
# DISCUSSION

- Open research questions for implementation:
  - Recognizing shapes
  - Obtaining information about surroundings
  - Influencing the surroundings
  - Sufficient variations and combinations



# DISCUSSION

- Future work on patterns:
  - Formulate more patterns
  - Surroundings and context
  - Expectations and perception
  - Pacing



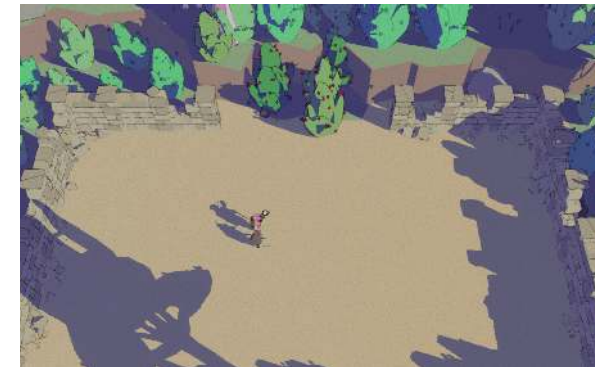
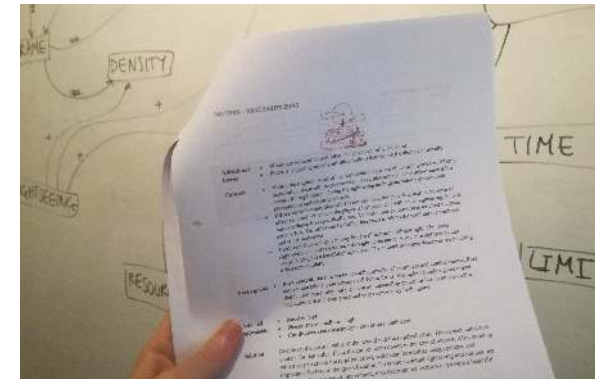
# RELATED WORK

- Appraisal Theory to *understand* how to affect emotions in games (Yannakakis & Paiva 2014)
- Experience-driven PCG (Yannakakis & Togelius 2011), Emotion-driven Level Generation (Togelius & Yannakakis 2016), Targeting horror via level and soundscape generation (Lopes et al. 2015)
- Design Patterns for Games (Bacher 2008; Björk & Holopainen 2003, Hullet & Whitehead 2010, Lemay 2007, Will 2013)
- Tools for Mixed-Initiative Game Design (Smith et al. 2011, Karavolos et al. 2015, van Rozen 2015), or Co-Creation (Guzdial et al. EXAG 2018!)



# CONCLUSIONS

- **Contributions:** Framework for capturing *design intent*
  - Pattern language: design patterns for affecting emotions
  - *Wonder* and appraisal patterns implemented
- **Future work:** surroundings, context, expectations, perception and pacing



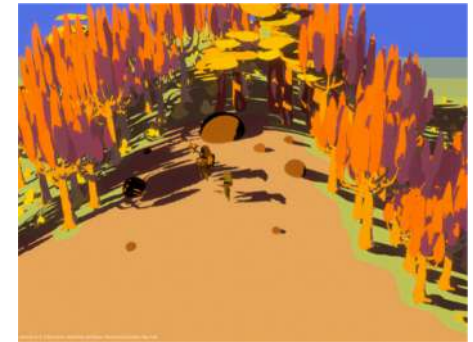
# ACKNOWLEDGEMENTS

## Project Live Game Design

- Amsterdam University of Applied Sciences
- Financially supported by NWO-SIA, Dutch funding body for applied research
- CWI, TU Delft, 12 Game Companies, DGG, DGA
- <http://livegamedesign.github.io/>

If you're interested, please contact us!

- **Rosa Corstjens** [r.a.s.corstjens@hva.nl](mailto:r.a.s.corstjens@hva.nl)
- **Anders Bouwer** [a.j.bouwer@hva.nl](mailto:a.j.bouwer@hva.nl)



## Game: The Sequel to Unexplored

- **Joris Dormans**, game designer, programmer
- **Hendrik Visser**, visual artist
- **Karel Millenaar**, designer
- **Matthijs Dierckx**, audio, PR & marketing
- **Rosa Corstjens**, programmer

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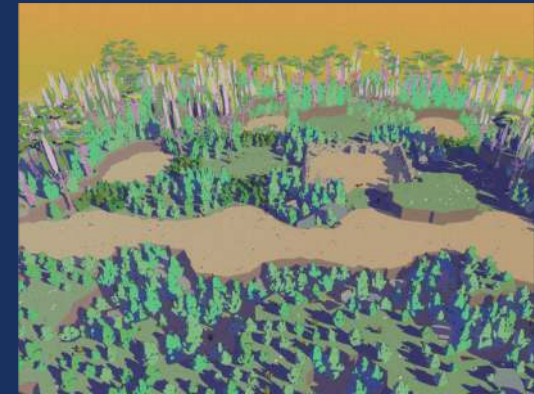
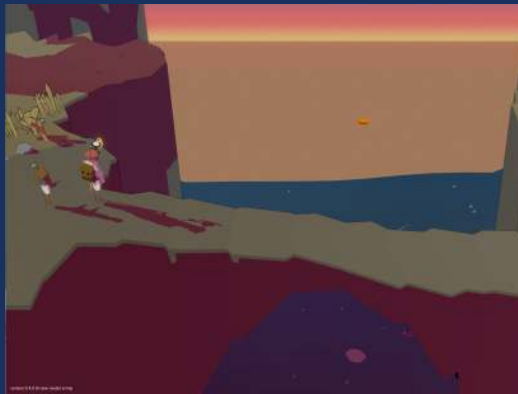
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# THANKS FOR YOUR ATTENTION!

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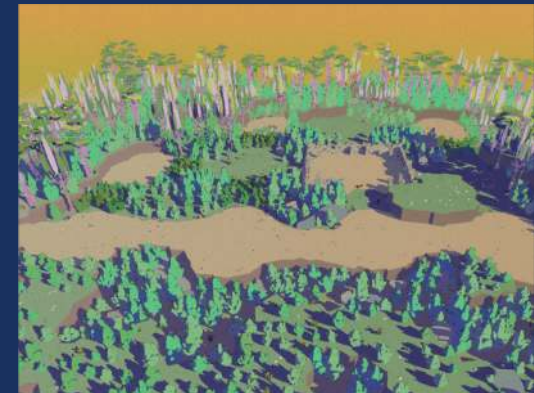
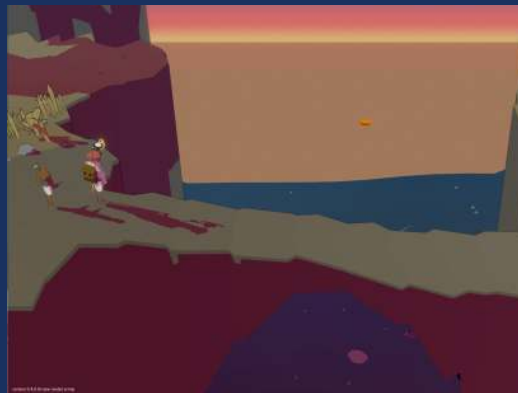
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# QUESTIONS?

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