Designer Empowerment through mixed-initiative Wave Function Collapse

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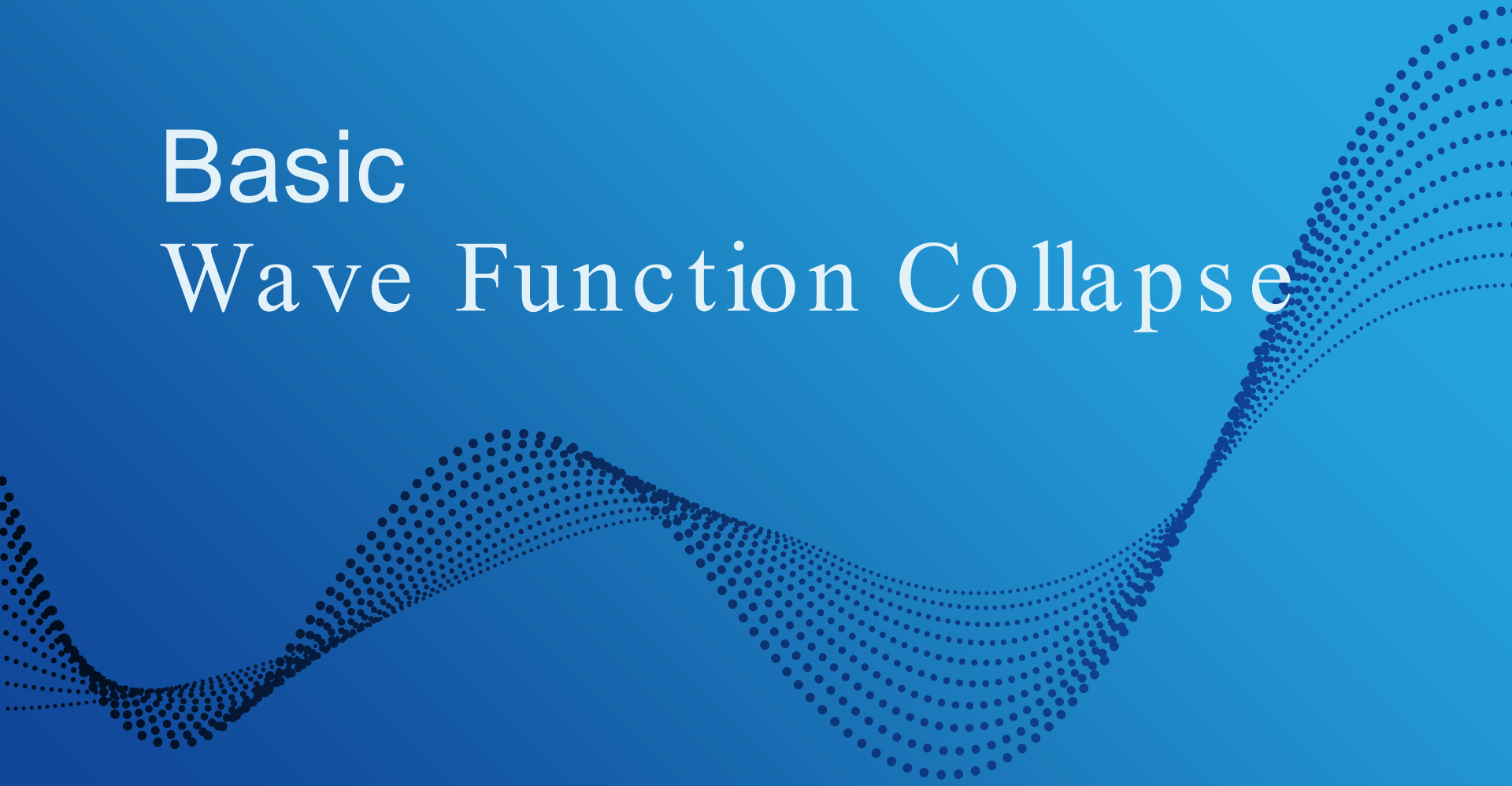
Introduction

- PCG methods aren't always super friendly…
- Mixed-initiative often helps improve them
- Wave Function Collapse (WFC) is awesome and popular but (so far…) isn't quite mixed-initiative

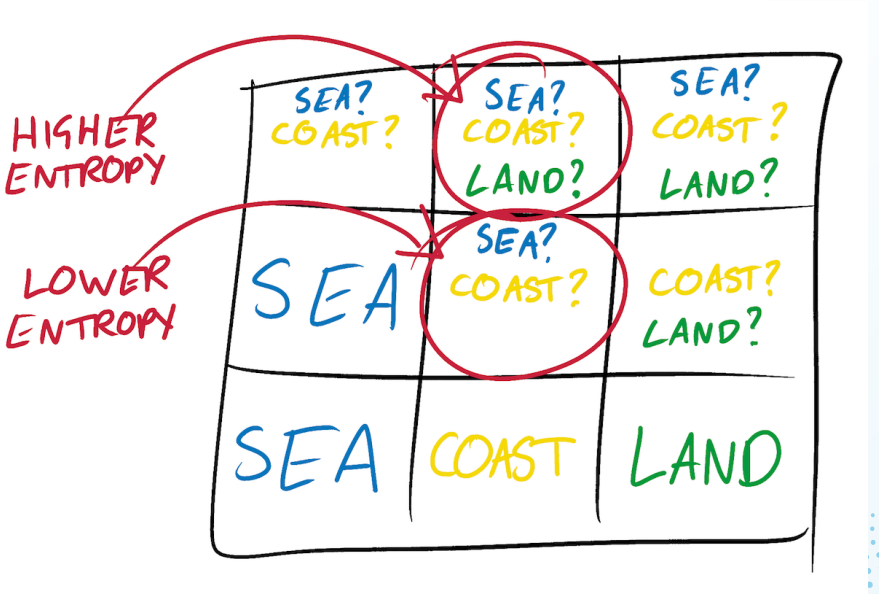
What does it take to make WFC into a mixed-initiative PCG method?

How can WFC advanced features be made usable by creative professionals in a responsive and intuitive way to explore a generative space?

Basic
Wave Function Collapse



Basic Wave Function Collapse



Basic Wave Function Collapse

- Adjacent Model
  - Based on Model Synthesis (P. Merrell)
- Overlapping Model
  - Processes an input image

```
1 initialize algorithm (building tile and constraint tables)
2 repeat
3         choose next cell to collapse
4         choose which tile to collapse it to
5         propagate
6 until all cells have collapsed or a conflict occurs;
```

Basic Wave Function Collapse

WFC Advantages:

- Requires a single input image
- Fast output generation
- Iterative
- Customizable to meet requirements (if you can code)

WFC Drawbacks:

- Non-trivial & uses complicated terms
- Lacks “undo” -ability
- Propagation is not always intuitive or predictable
- Tile selection is non -controllable
- Using custom input that yields desired output is hard to create

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Mixed-Initiative WFC

- Integrate more control into useful WFC extensions
- Overcome WFC drawbacks with mixed-initiative approach
- Iteratively evaluate our prototype implementation, **miWFC**

1.History Navigation

Interactive navigation through design history

History navigation

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2. Direct Manipulation

Precise manual editing of the output

Direct Manipulation

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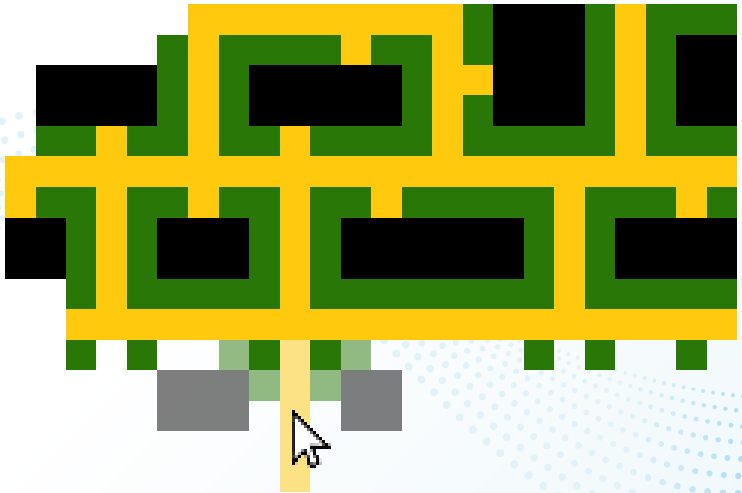
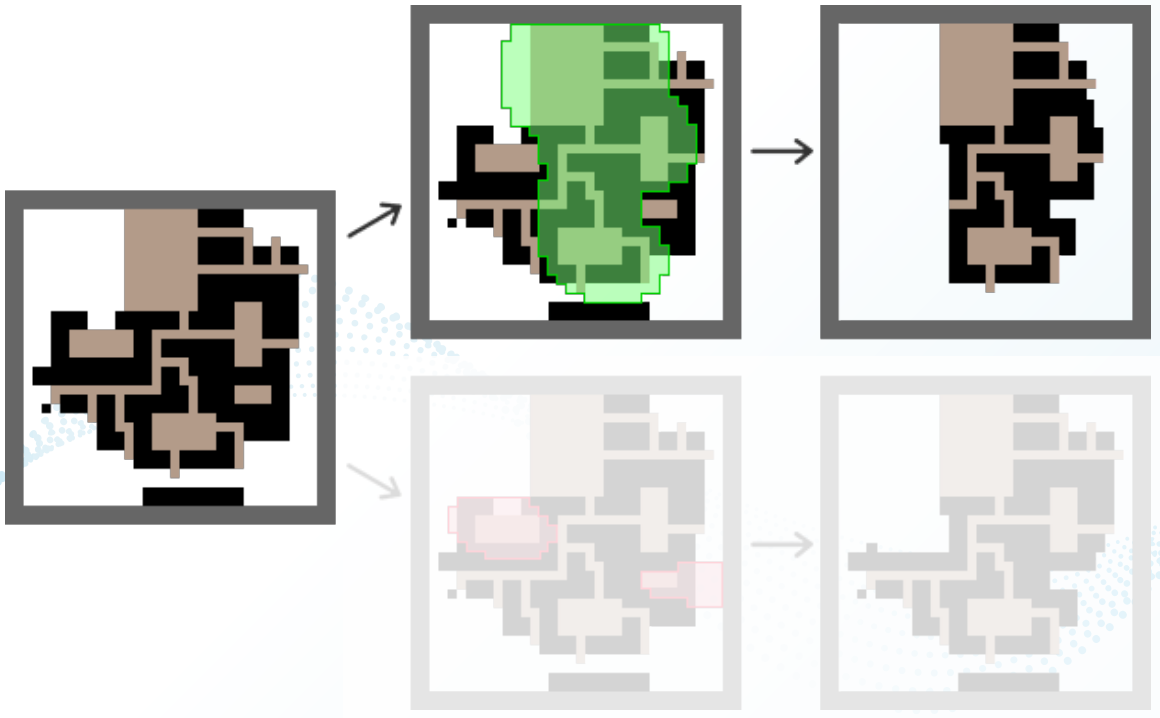
Direct Manipulation - Pencil Tool



Direct Manipulation - Brush Tool



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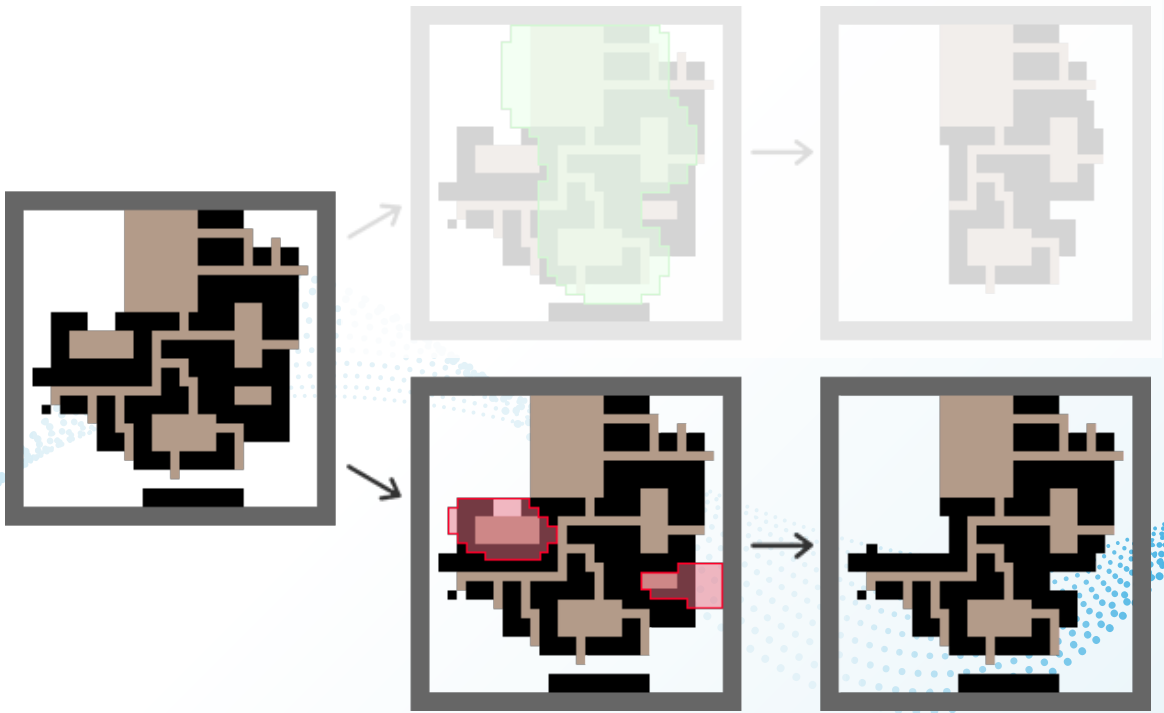
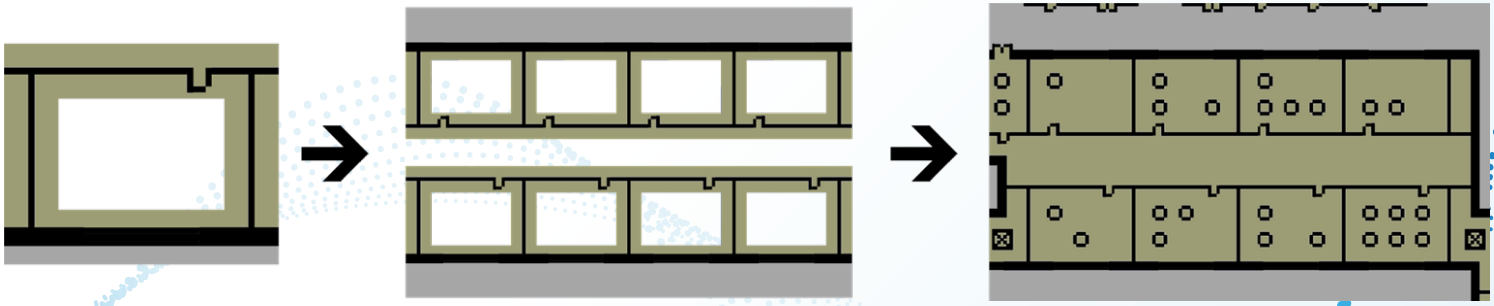


Direct Manipulation - Templating Tool



3. Tile and Pattern Manipulation

Tweaking of global output appearance

Tile and Pattern Manipulation

```
1 initialize algorithm (building tile and constraint tables)
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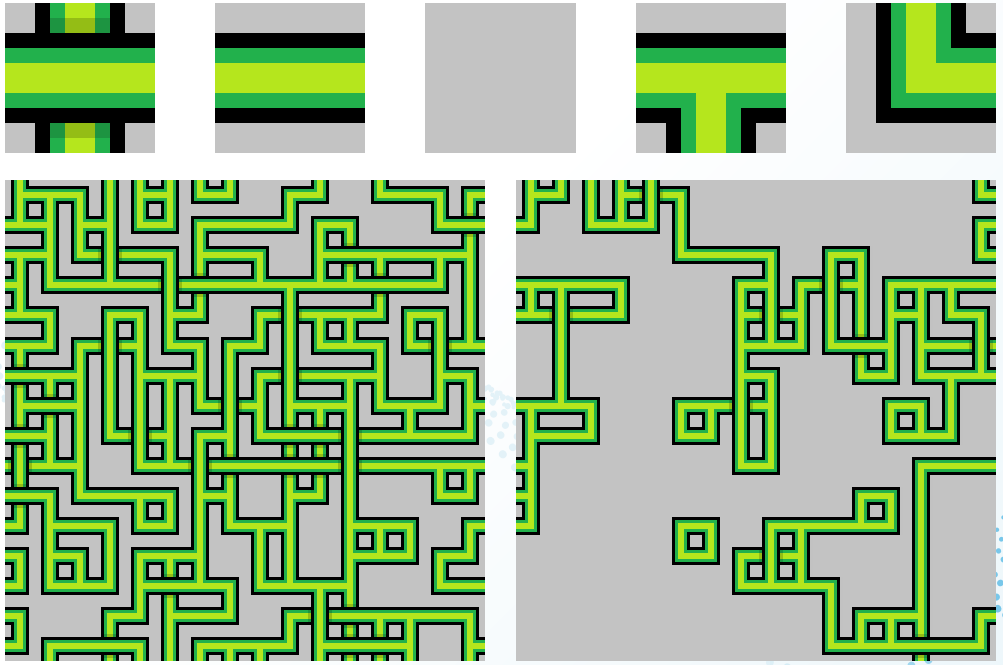
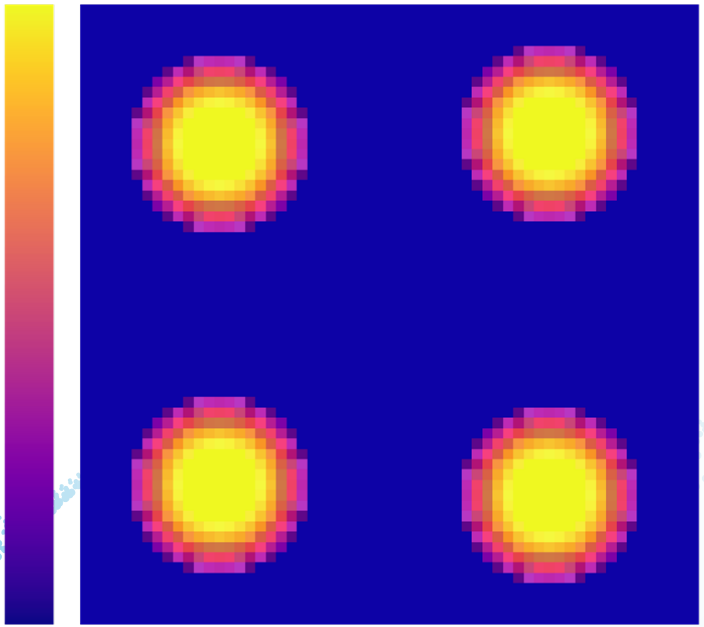
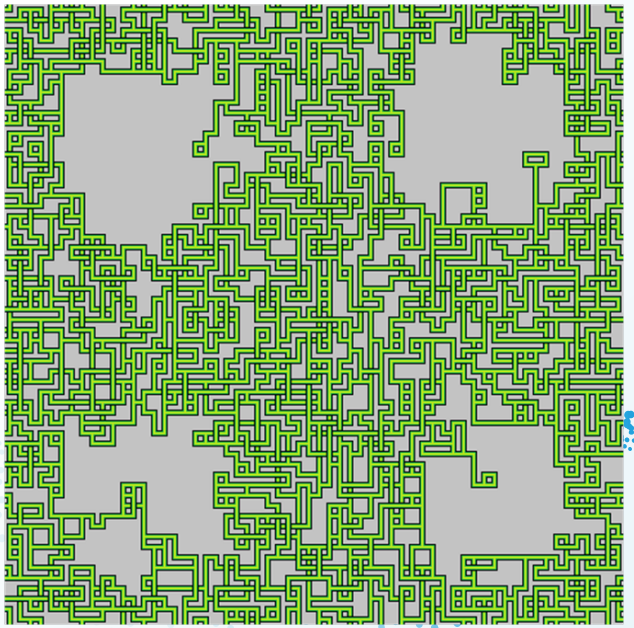
Weight Manipulation

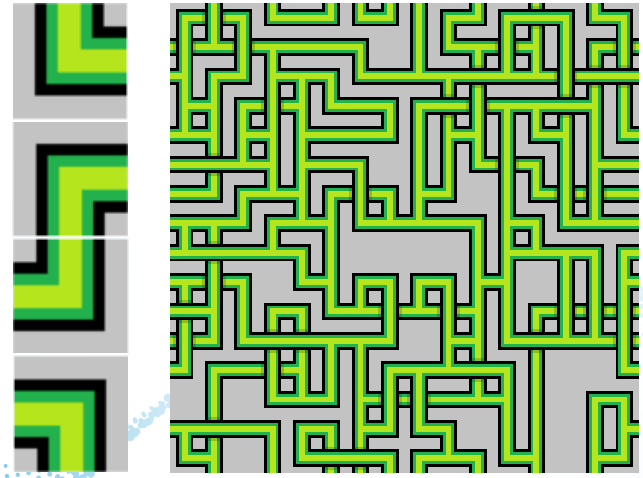


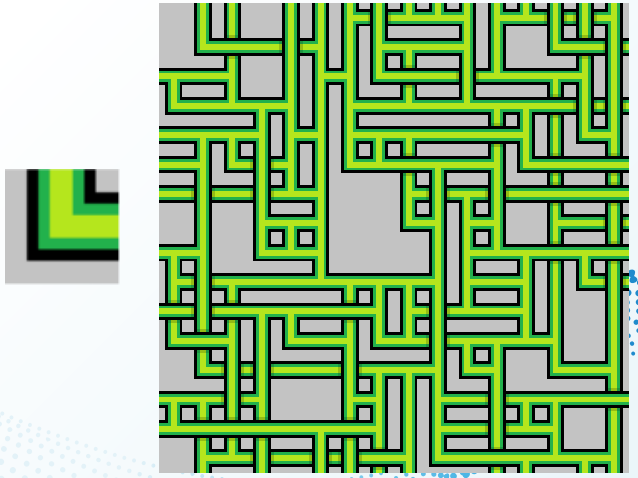
Weight Manipulation



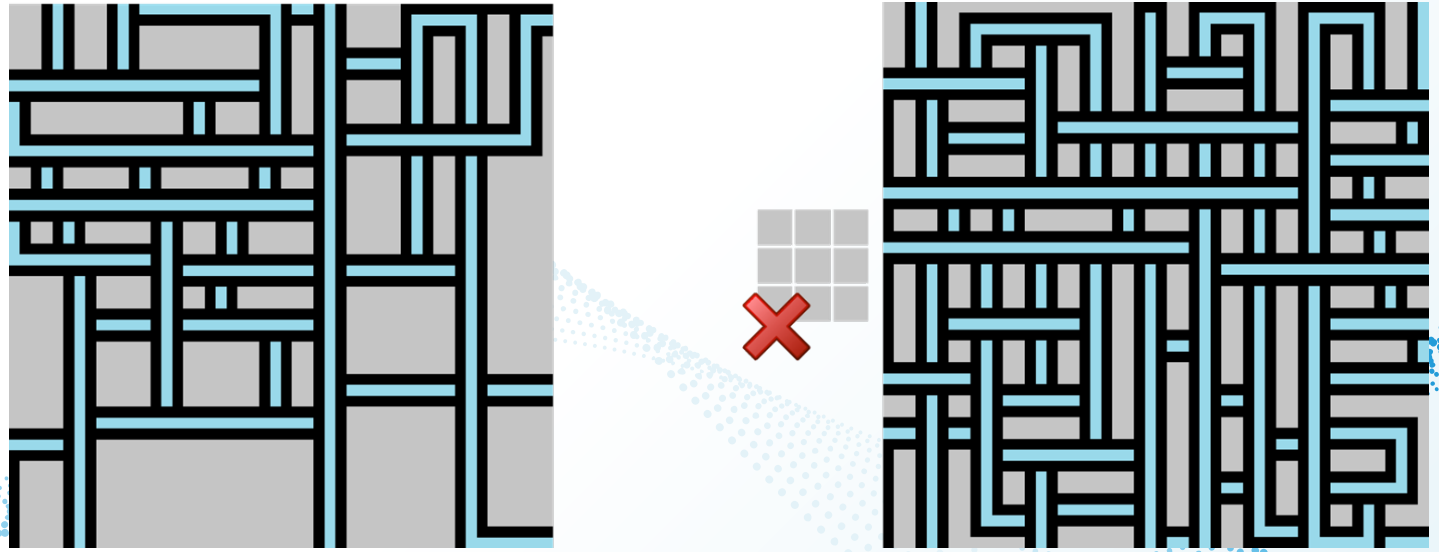


Transformation Manipulation

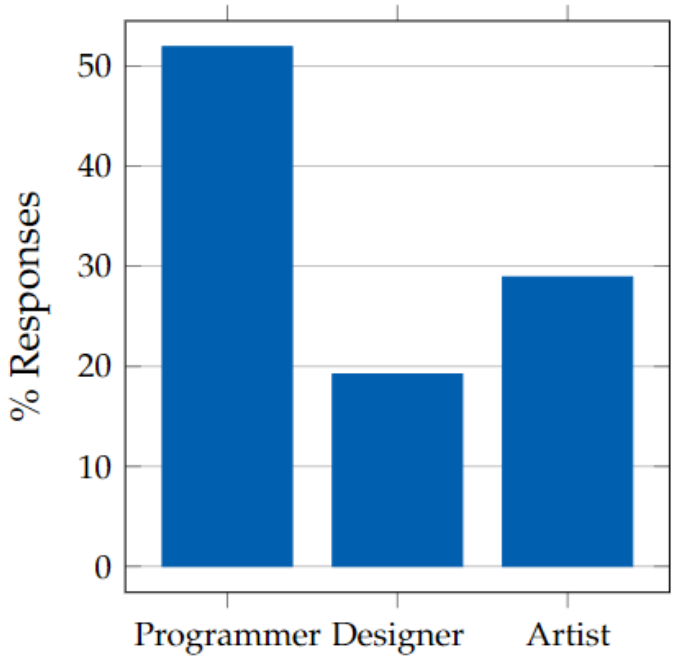




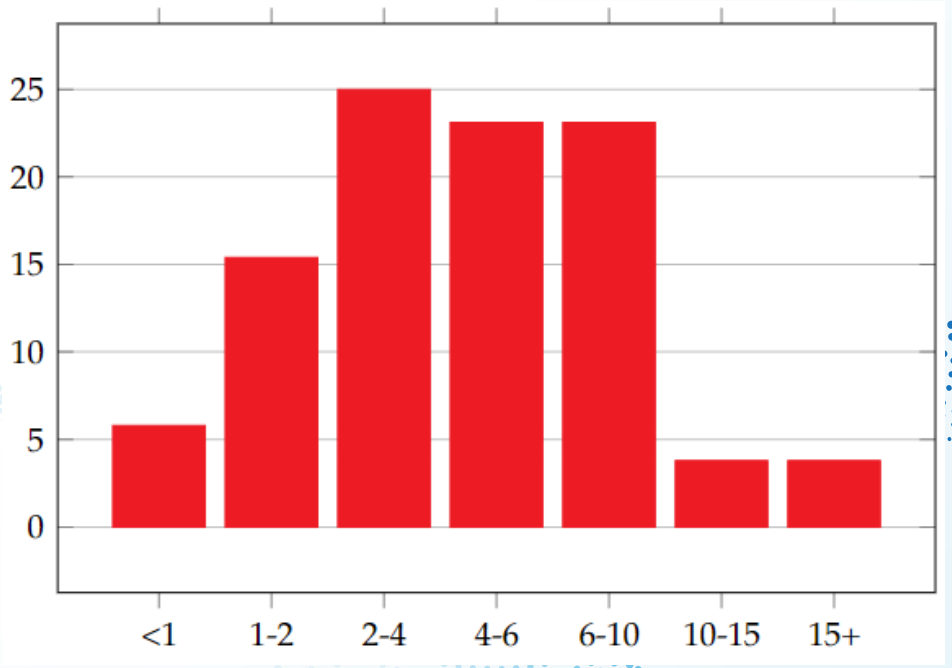
Pattern Manipulation



Evaluation

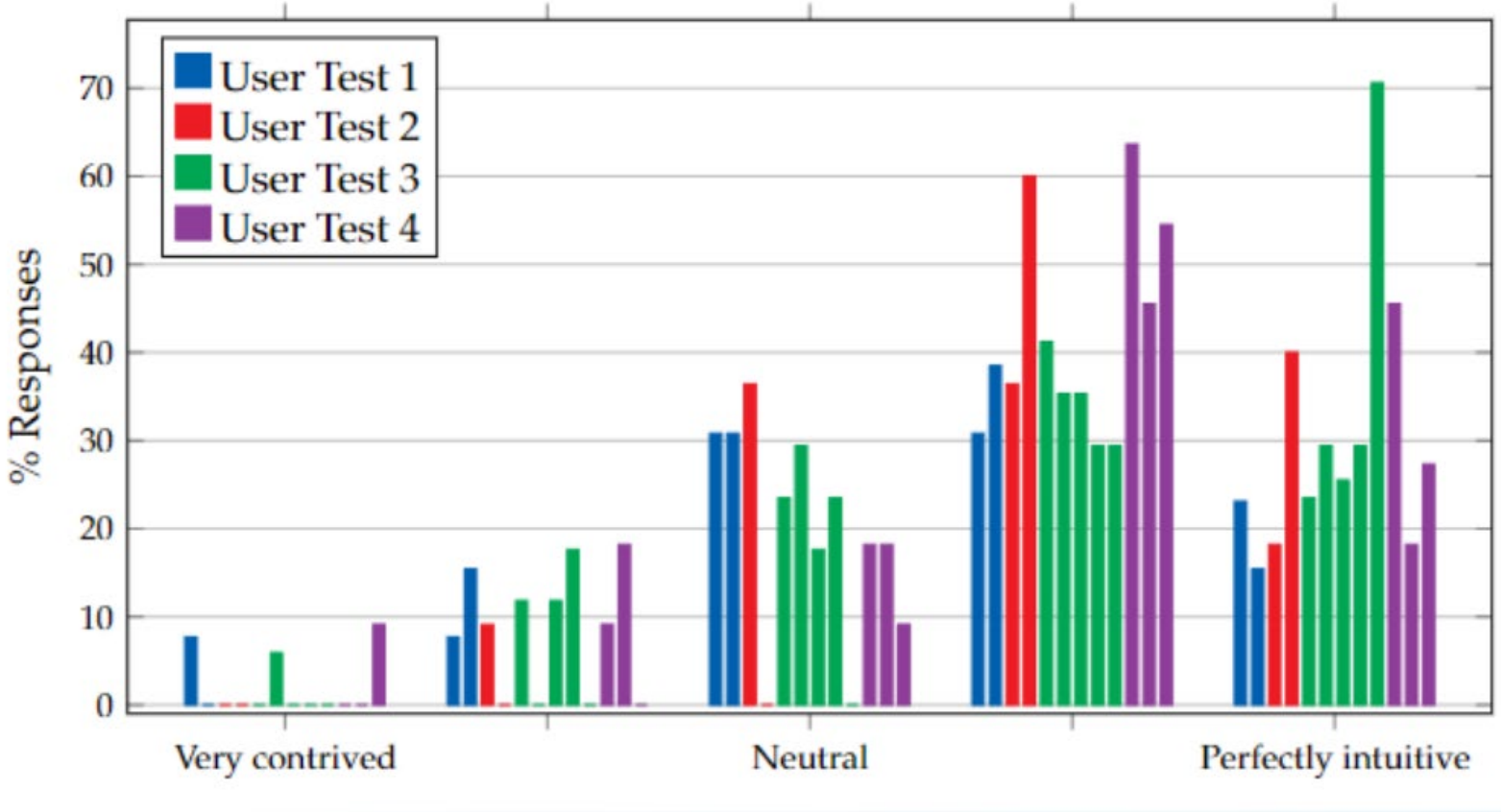


Relation to PCG

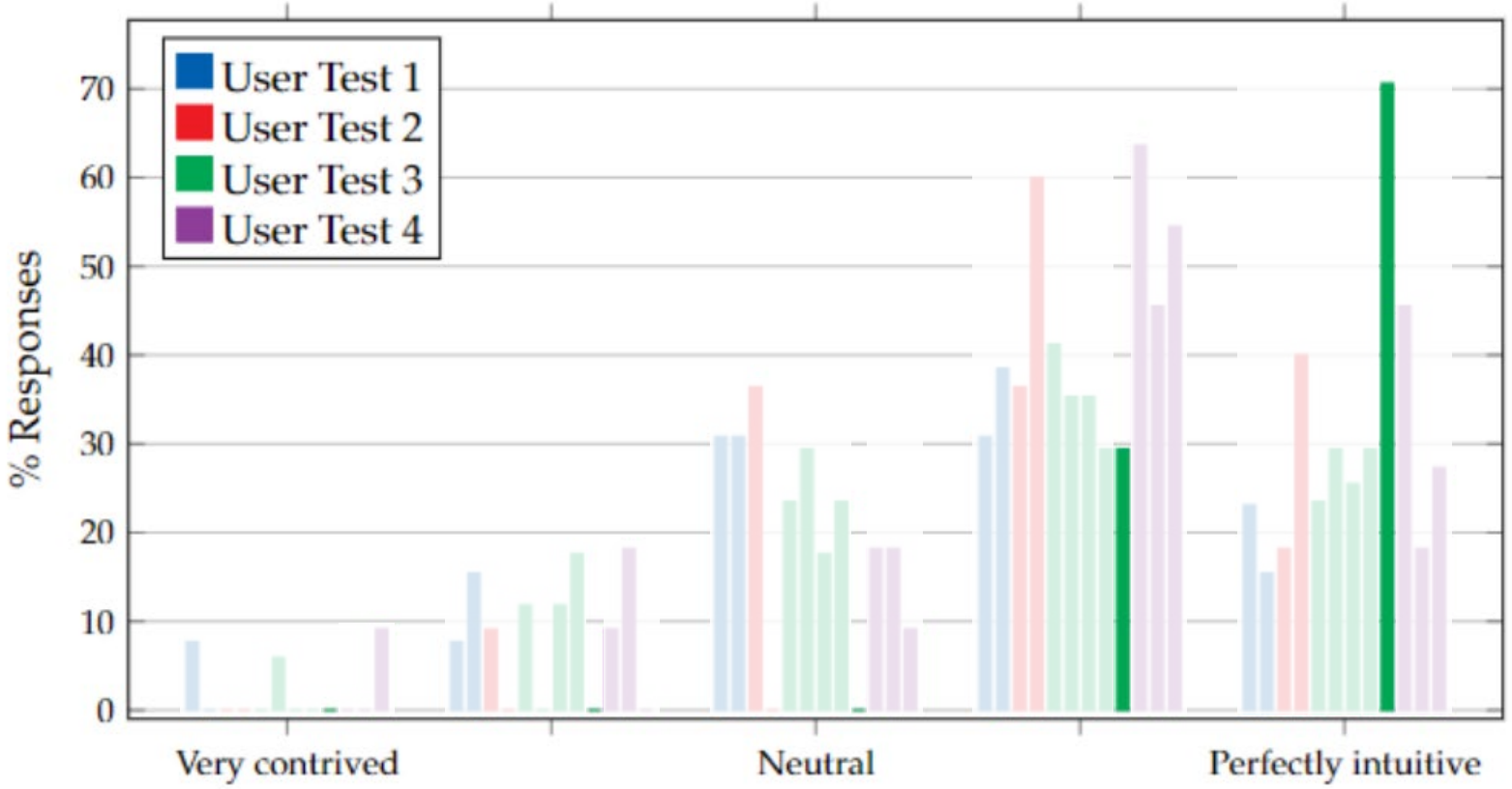


Experience [years]

Evaluation


User Test 1
User Test 2
User Test 3
User Test 4
% Responses
70
60
50
40
30
20
10
0
Very contrived
Neutral
Perfectly intuitive

Evaluation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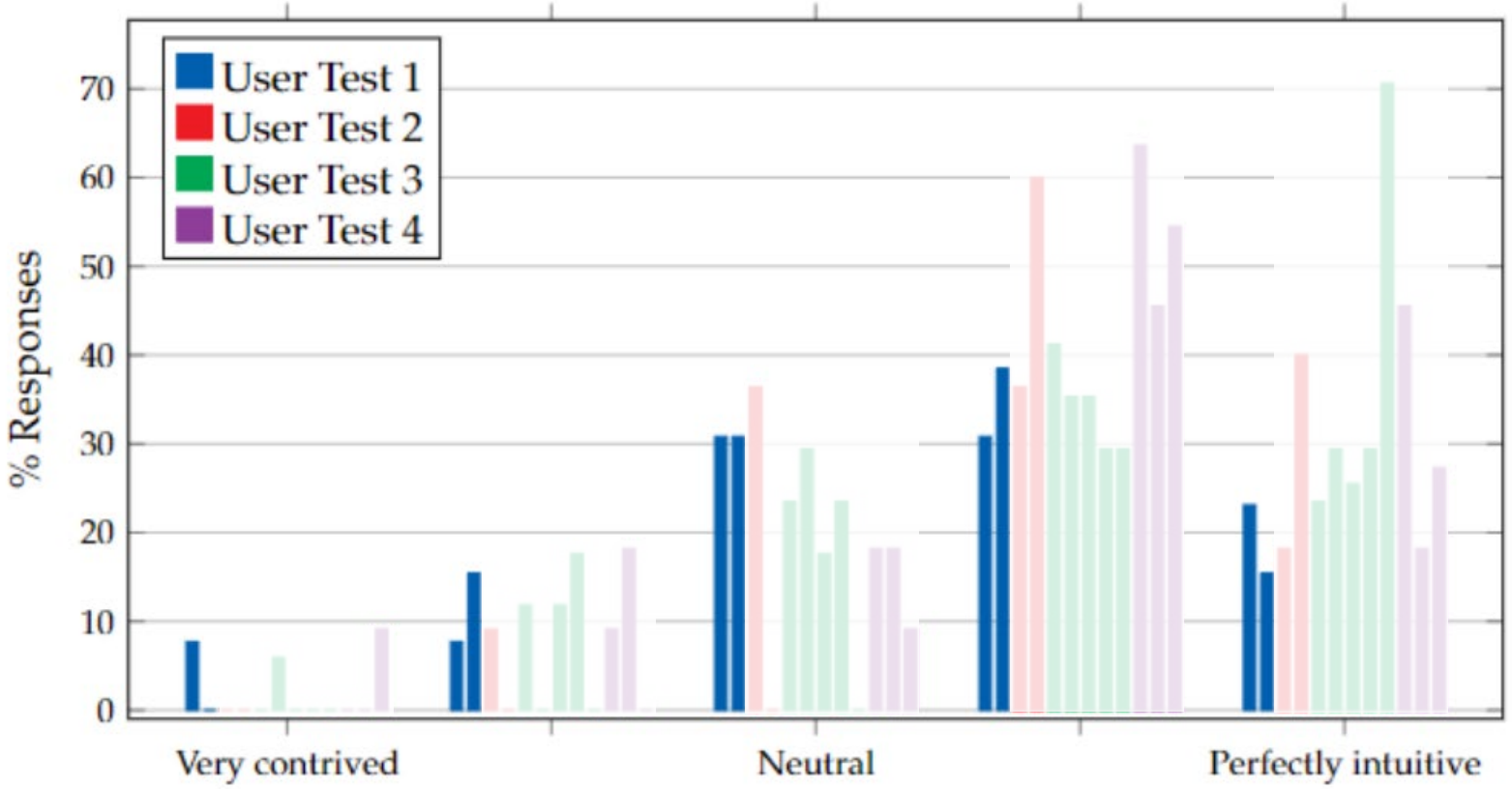
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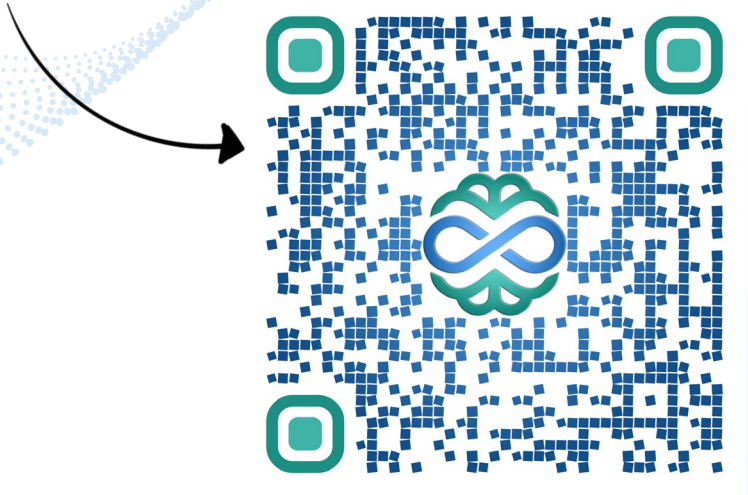
Conclusion

- WFC is powerful but lacks intuitive control
- Provided through our designed features:
  - History Navigation
  - Direct Manipulation
  - Tile & Pattern Manipulation

Thank you for your attention!

Prototype
Download



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