

# Evolutionary Lighting

...a genetic algorithm implementation for task lighting design.

# **task lighting** - design - evaluation - examples - future work



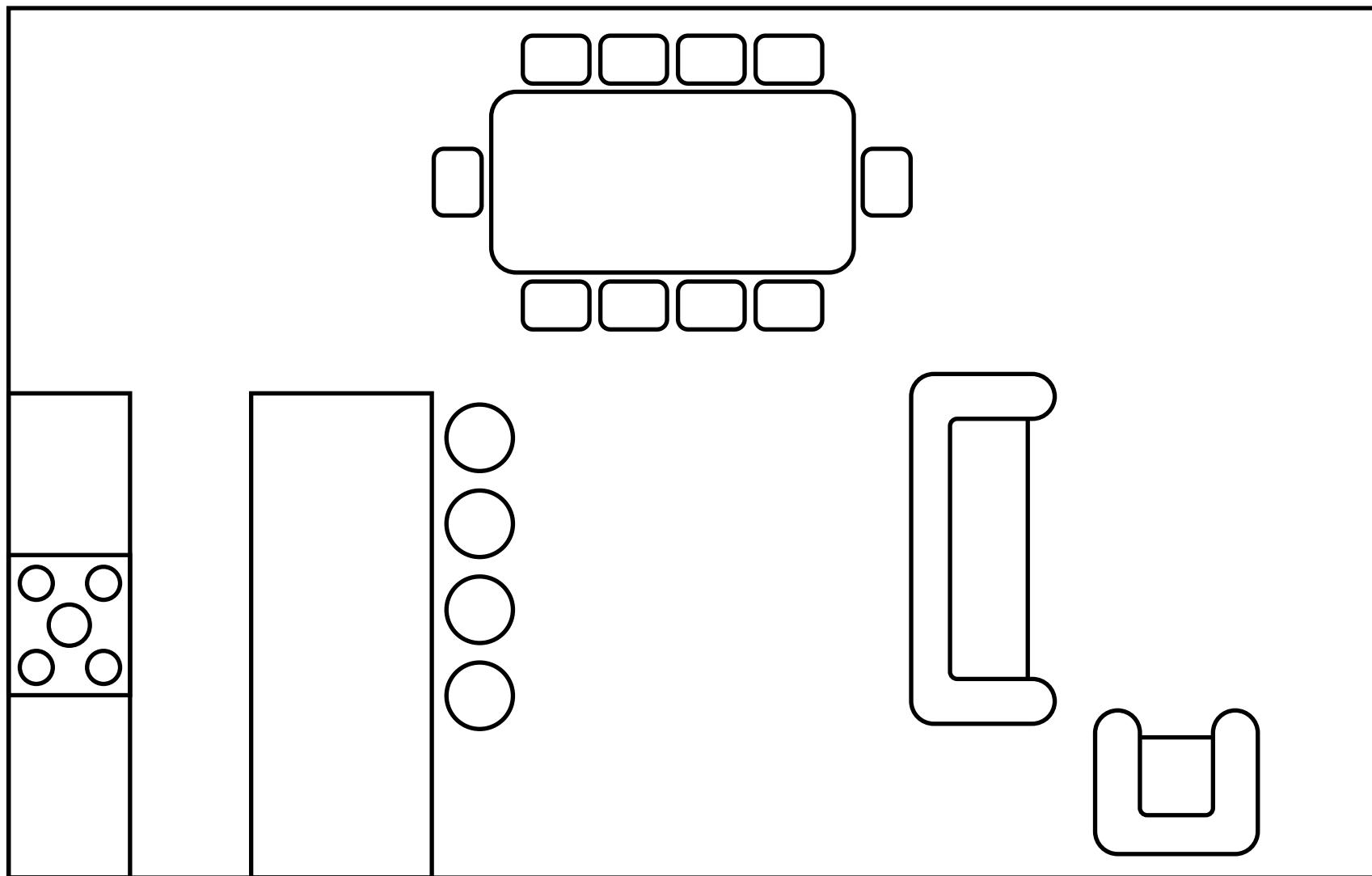
**Food Prep/Kitchen**  
50-100 footcandles

**Reading/Working Area**  
20-50 footcandles



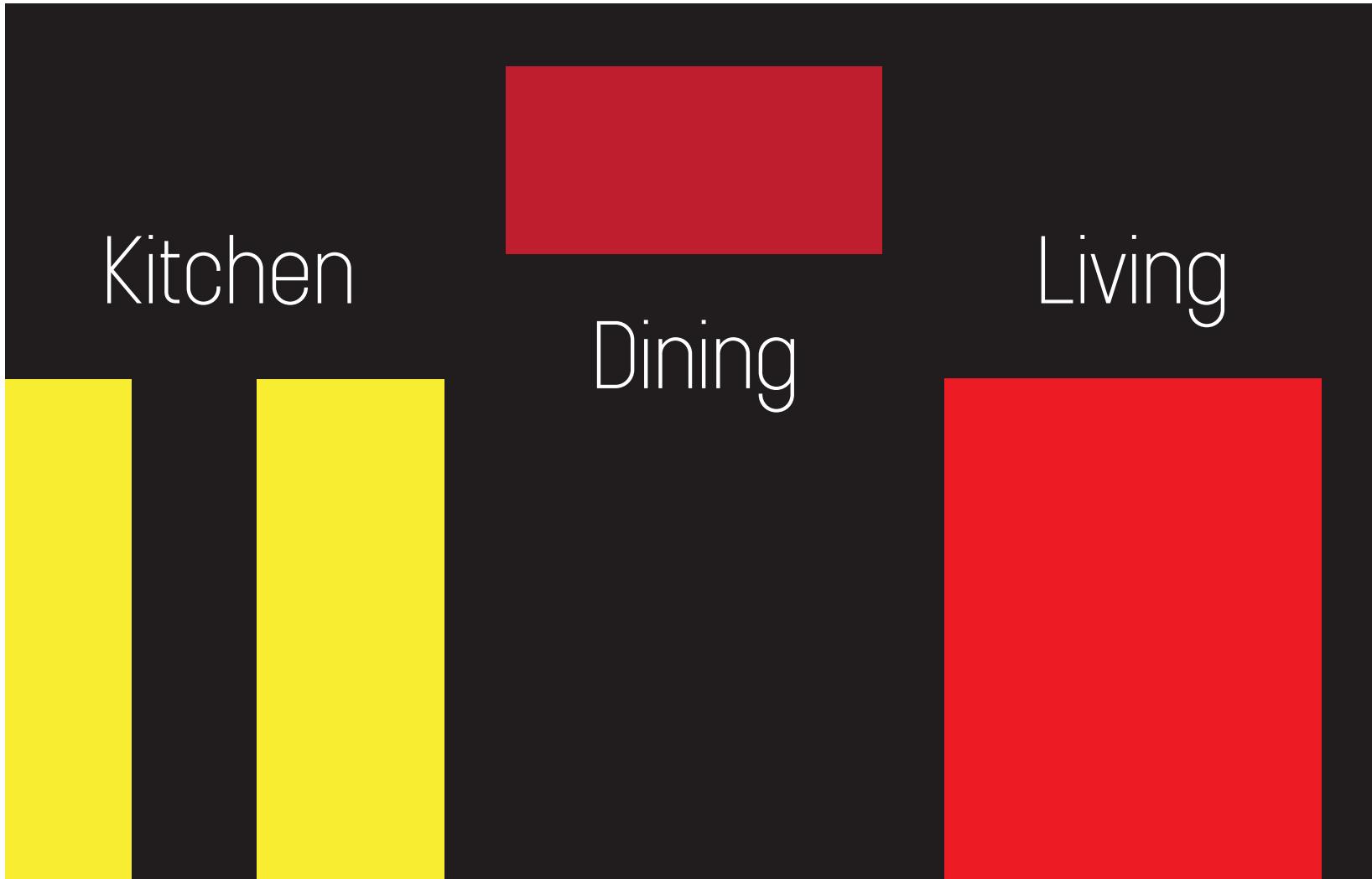
**Dining/Eating Area**  
5-20 footcandles

# task lighting - design - evaluation - examples - future work



Floor Plan

# **task lighting** - design - evaluation - examples - future work

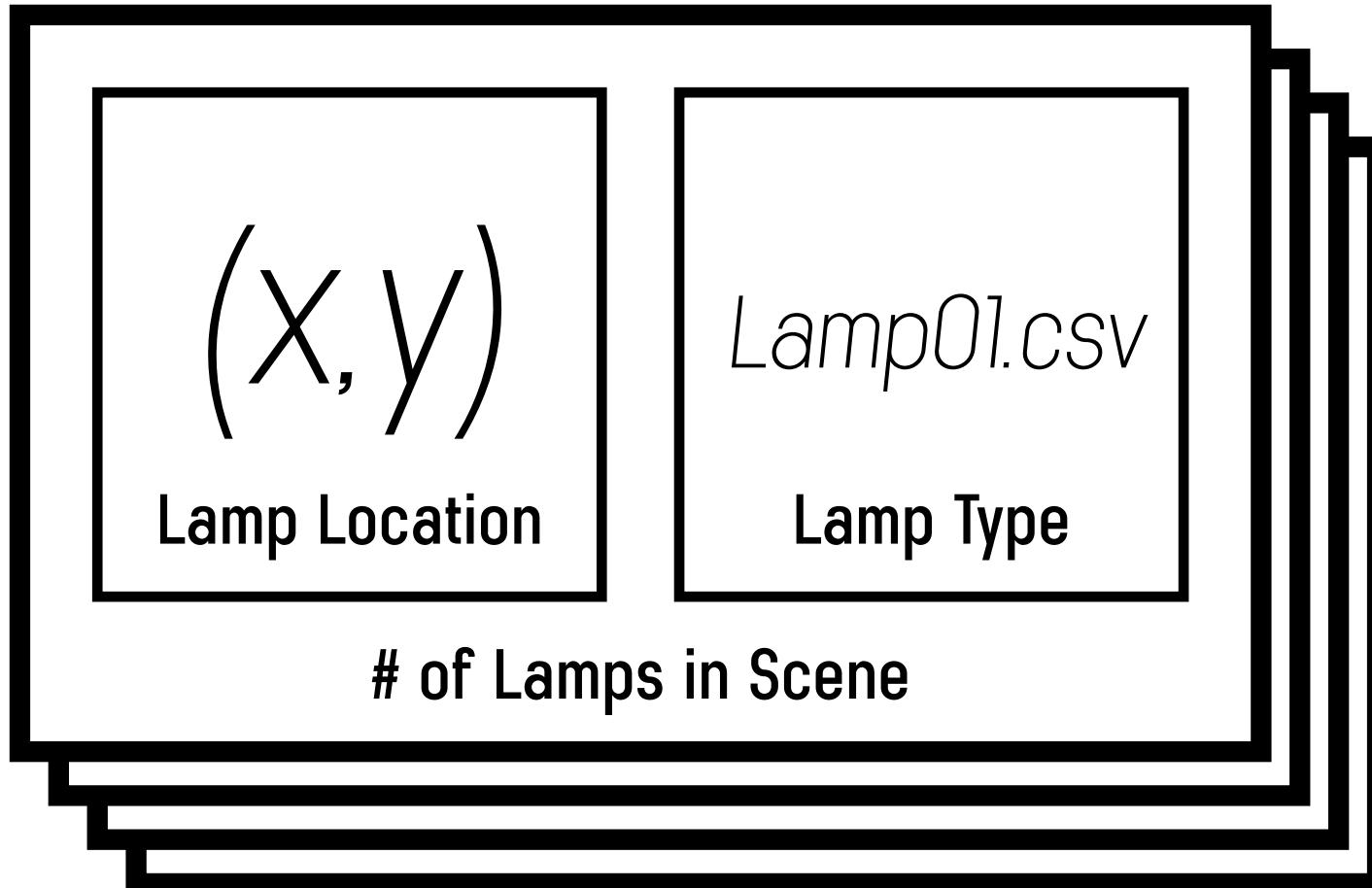


**Task Lighting Needs - Visualized**

03

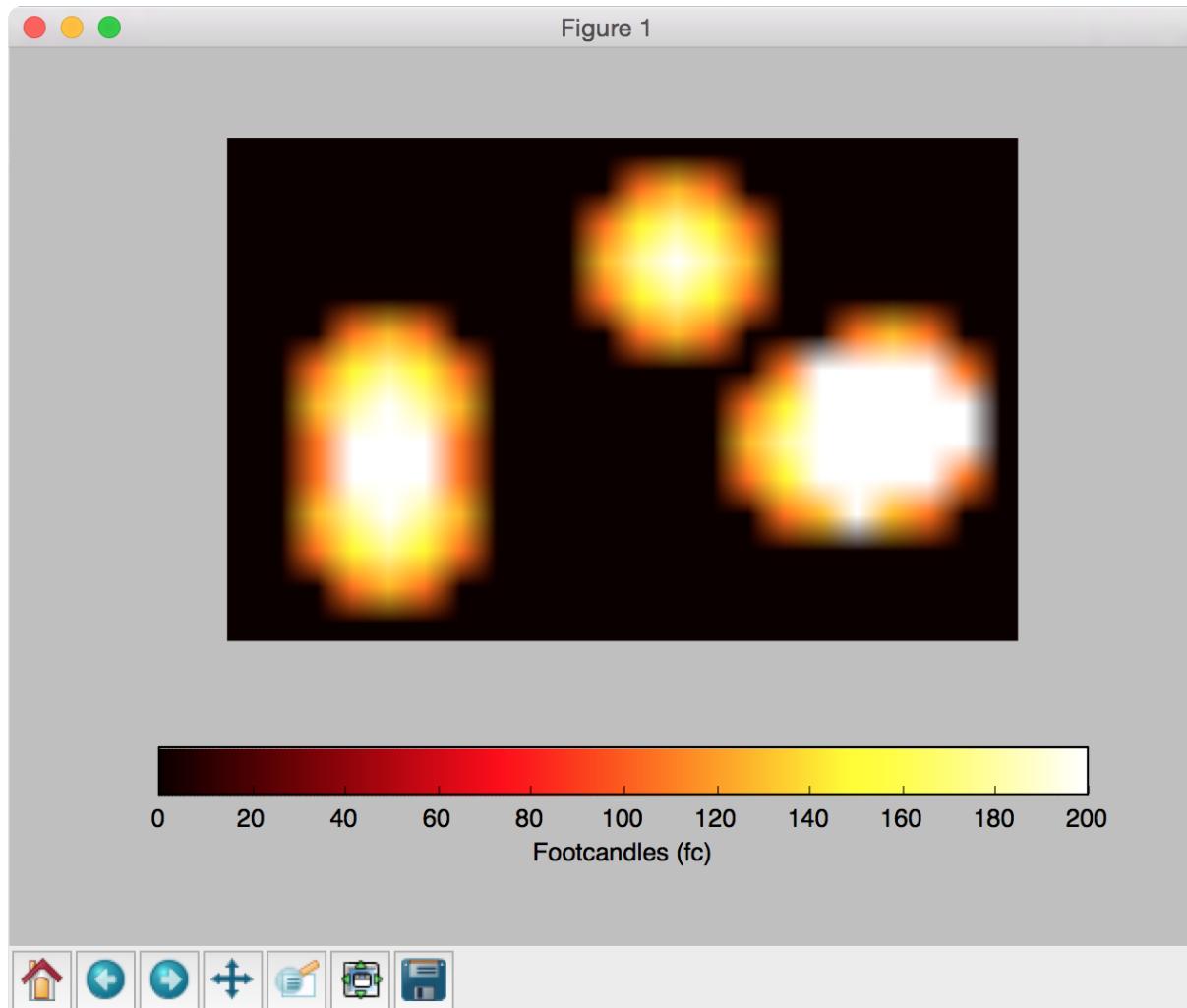
# **task lighting** - design - evaluation - examples - future work

# lighting\_plan01.csv



$[[x_1, y_1, l_1], [x_2, y_2, l_2], [x_3, y_3, l_3], \dots, [x_n, y_n, l_n]]$

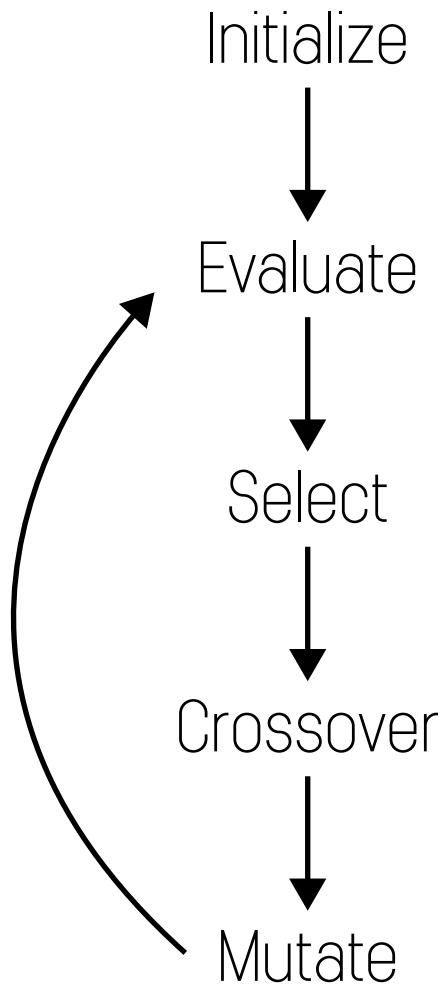
task lighting - **design** - evaluation - examples - future work



`[[4, 9, 0], [17, 9, 0], [17, 2, 0], [1, 5, 0], [9, 0, 0], [4, 8, 0]]`

Lighting Scene Demo

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# task lighting - design - **evaluation** - examples - future work

```
def fitness(child):
    score = 0
    difference = np.subtract(solution, child)
    for elements in difference.flat:
        if elements < 0:
            score += abs(elements)*underPenalty
        if elements > 0:
            score += abs(elements)*overPenalty
    return score
```

150	150	150	0	0
150	0	0	0	0
0	0	0	100	100
0	0	0	100	100
150	0	0	100	100

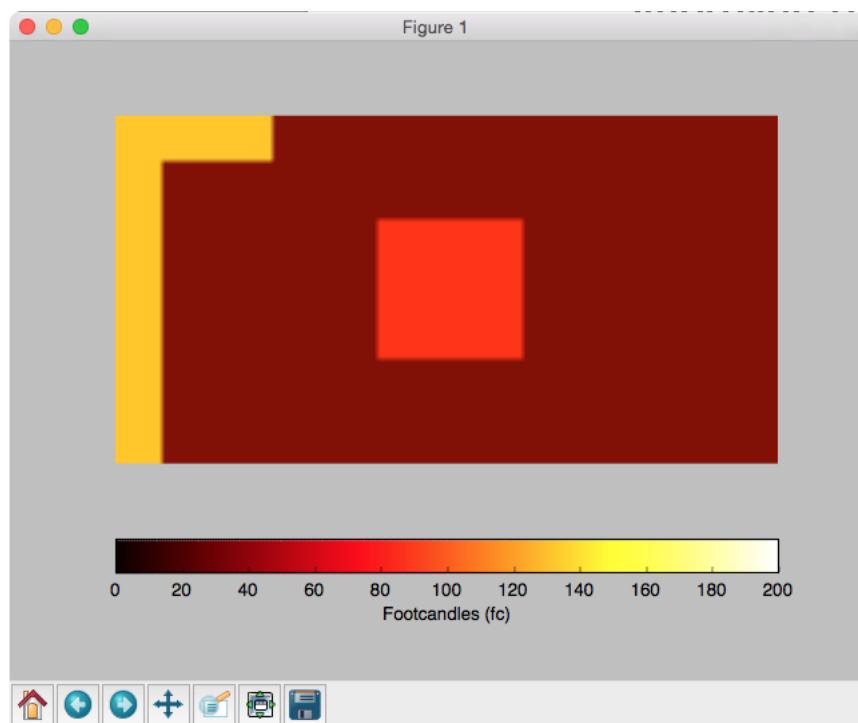
Solution

150	150	150	0	0
150	150	150	0	0
150	150	150	0	0
0	0	0	150	150
0	0	0	150	150

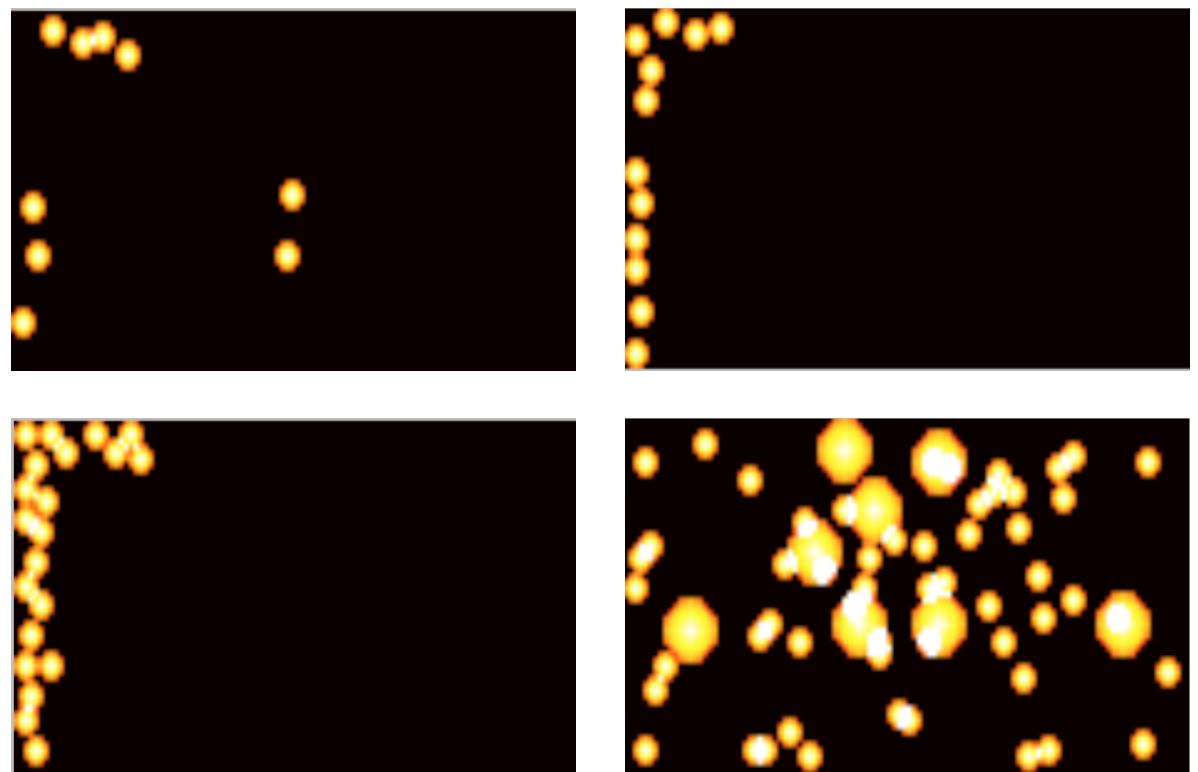
Child

0	0	0	0	0
0	-150	-150	0	0
-150	-150	-150	100	100
0	0	0	-50	-50
150	0	0	-50	-50

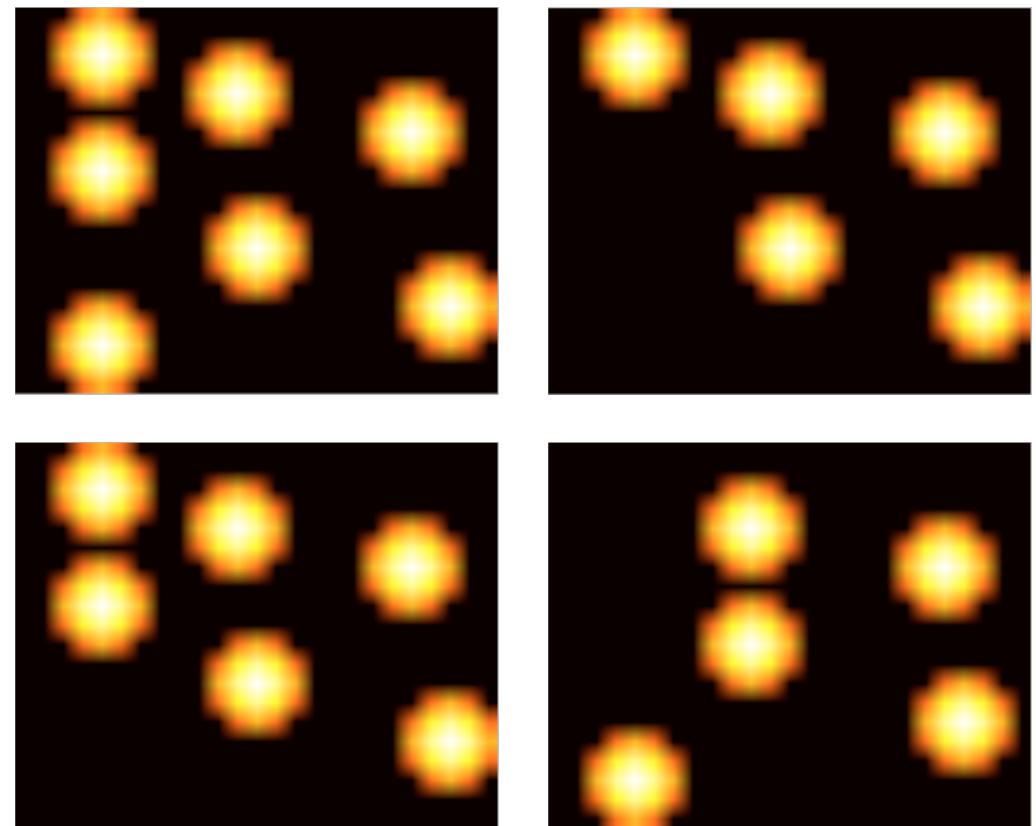
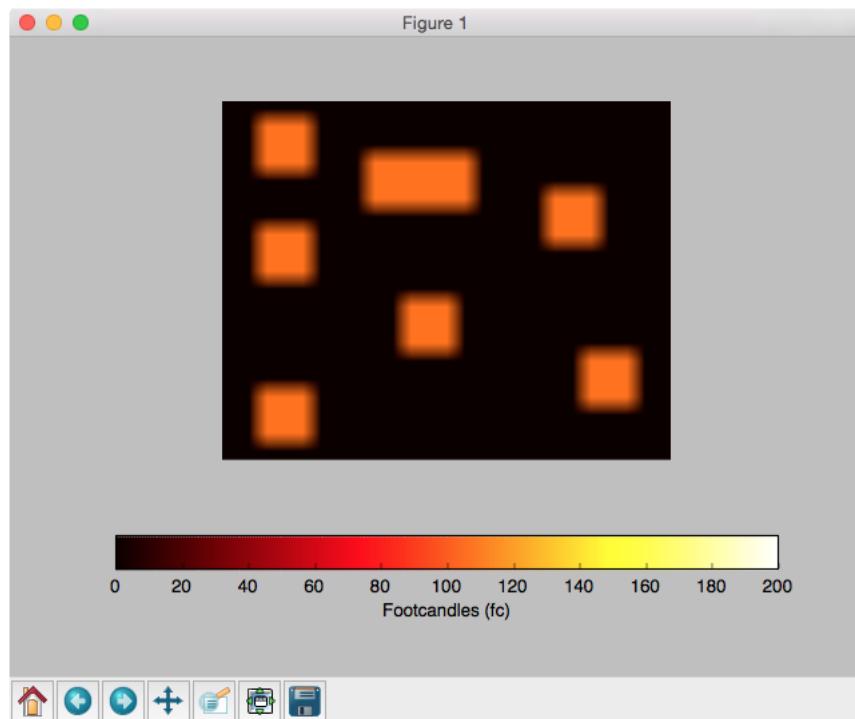
Difference



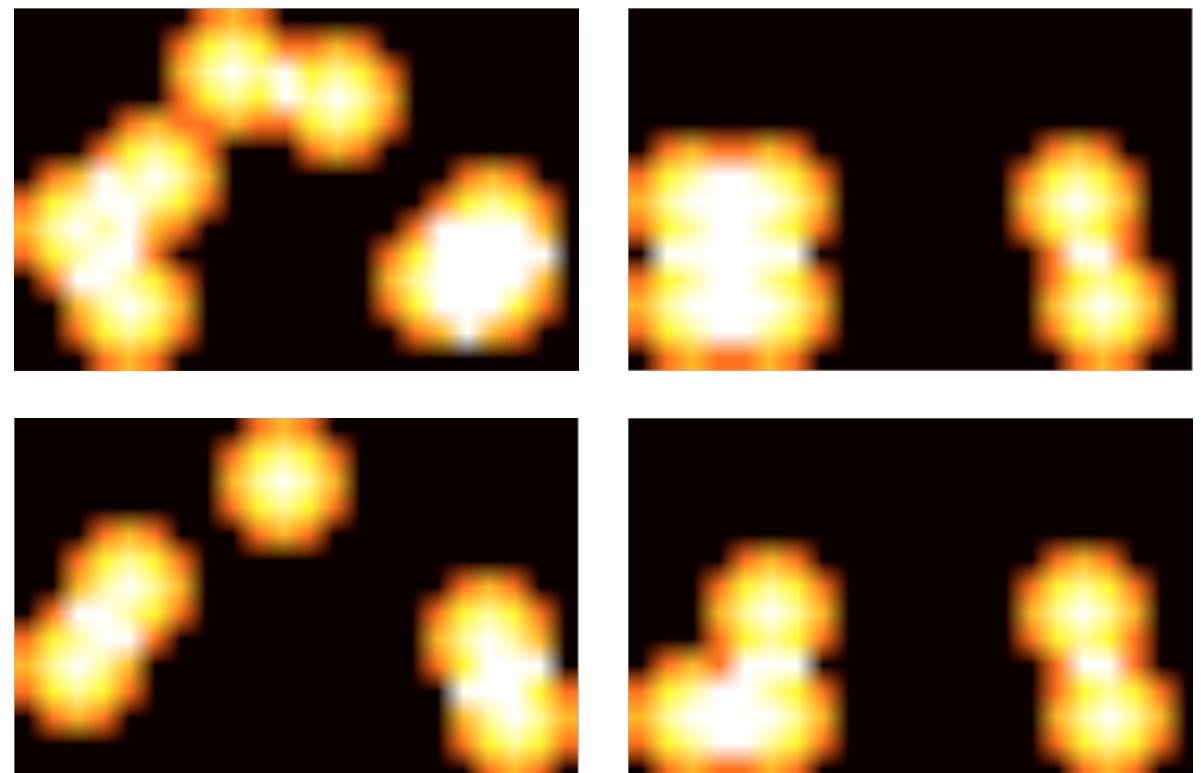
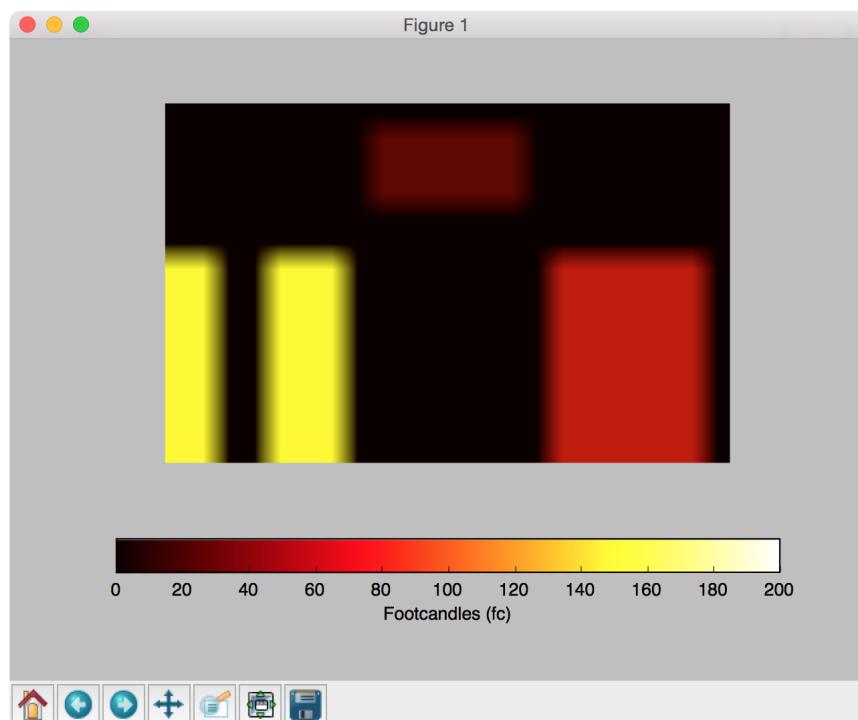
114 x 60



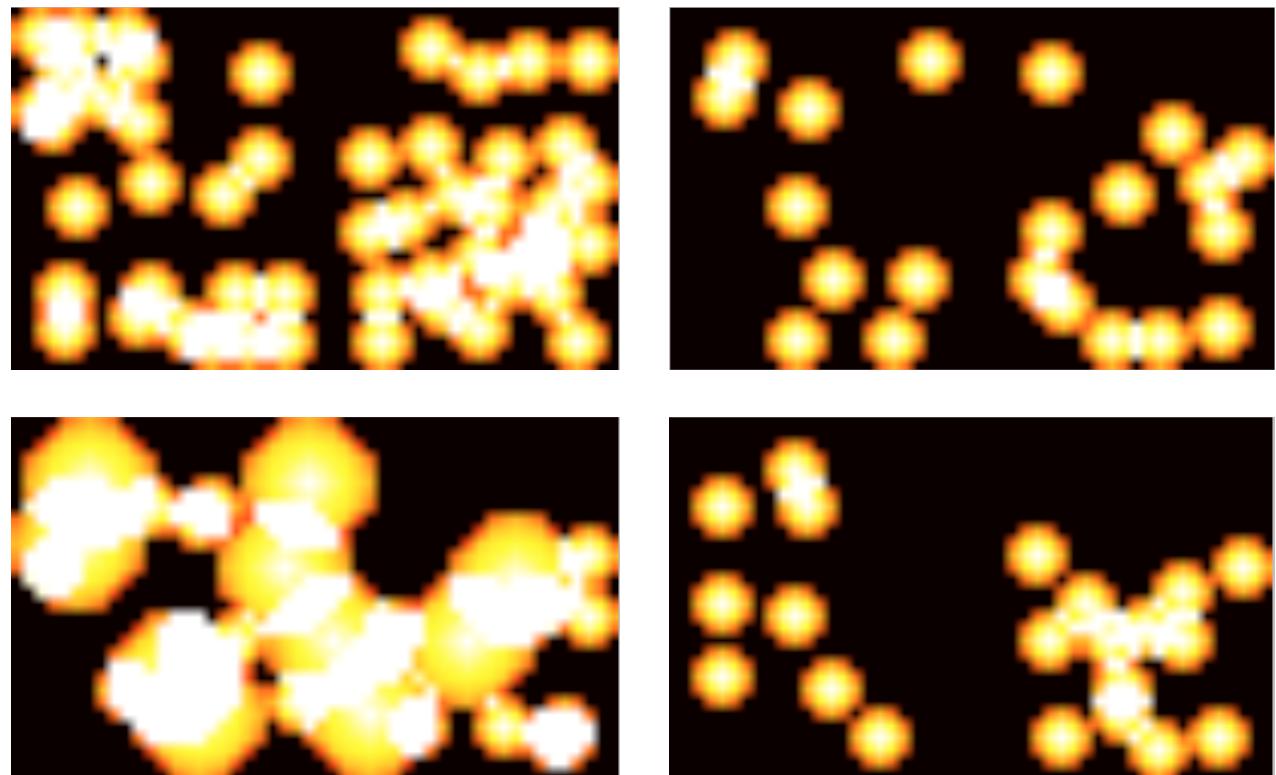
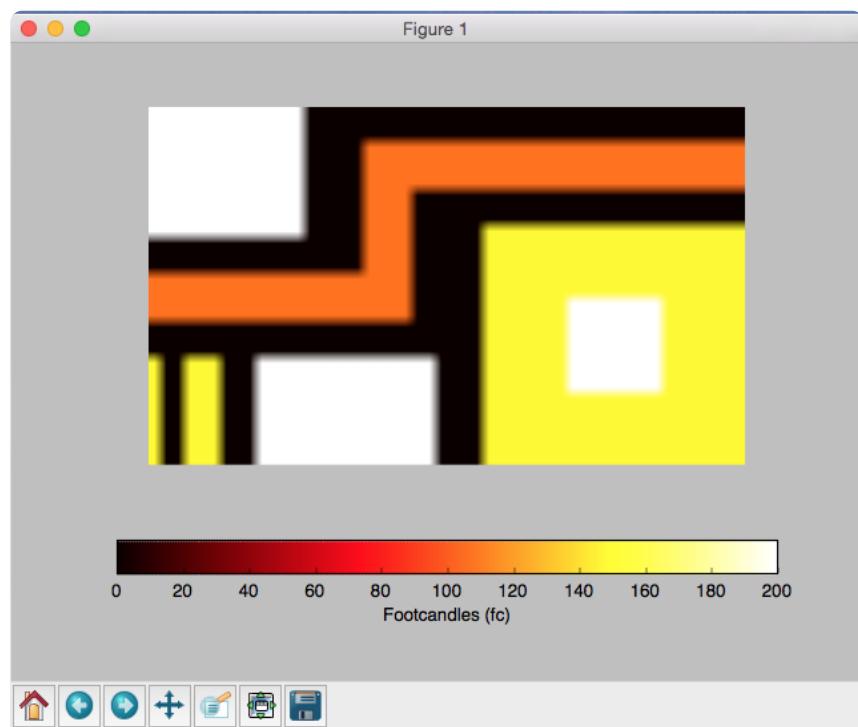
Example 1 : Large Grid + Ambient Lighting



Example 2 : Small Grid + Islands

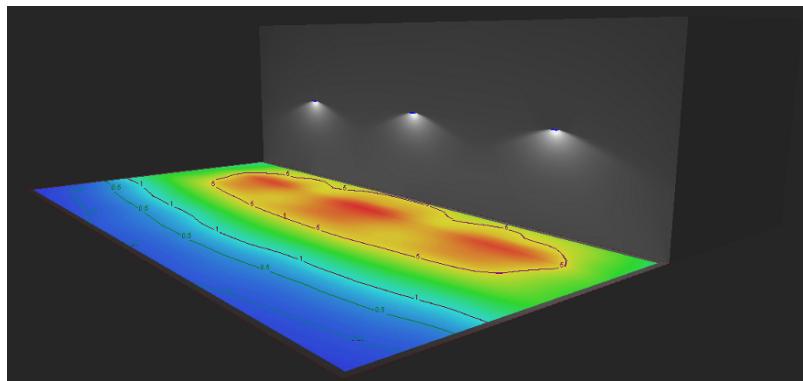


Example 3 : Small Grid + Islanded Zones



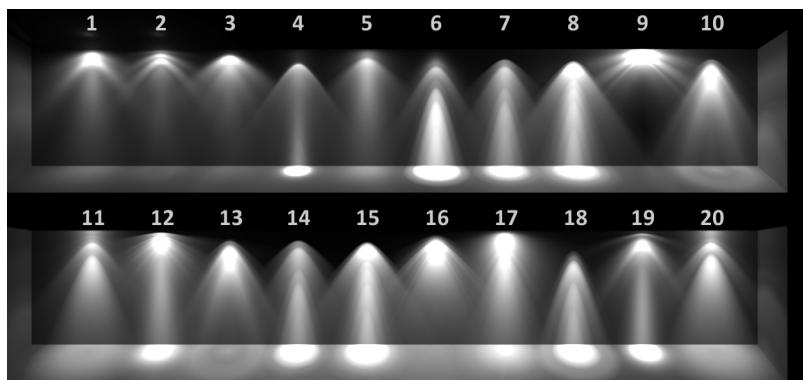
Example 4 : Medium Grid + High Density Zones

# task lighting - design - evaluation - examples - **future work**



**3D Analysis**  
Z-Axis  
Angled Lamps

**Improved Optimization**  
Evolution Strategies  
Divide & Conquer



**User Interface**  
Compatibility with .ies Files  
CAD Import Functionality