

The background of the slide features three large, blue wind turbines standing on a calm blue sea under a pale, hazy sky. The turbines are positioned at different intervals across the horizon, with the one on the right being the most prominent and largest.

# Tatami Maker: A Combinatorially Rich Mechanical Game Board

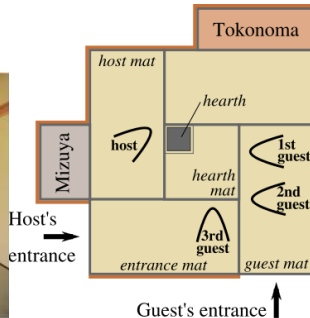
Alejandro Erickson

University of Victoria  
Bridges 2013, Enschede, the Netherlands

July 27-31, 2013

# Japanese Tatami mats

Traditional Japanese floor mats made of soft woven straw.






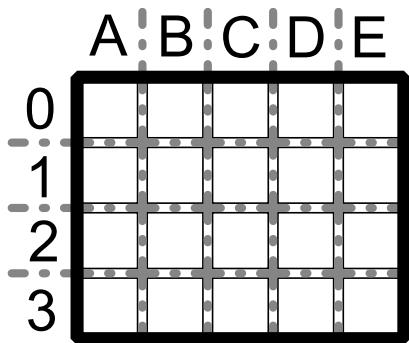
A 17th Century layout rule:  
**No four mats may meet.**

# Let's play a game

## Tatami restriction

No four tiles meet (e.g. at grid intersections).

Tatami-cover the  $4 \times 5$  grid with dominoes,  and , and monominoes, . Add or remove a tile.



# Mathematical history

## No four dominoes (mats) may meet

Tatami coverings of rectangles were considered by Mitsuyoshi Yoshida, and Don Knuth (about 370 years later).

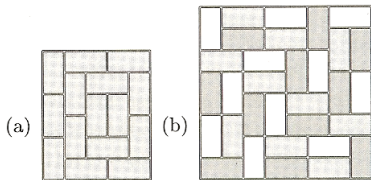
215. [21] Japanese tatami mats are  $1 \times 2$  rectangles that are traditionally used to cover rectangular floors in such a way that no four mats meet at any corner. For example, Fig. 29(a) shows a  $6 \times 5$  pattern from the 1641 edition of Mitsuyoshi Yoshida's *Jinkōki*, a book first published in 1627.

Find all domino coverings of a chessboard that are also tatami tilings.

Fig. 29. Two nice examples:

(a) A 17th-century tatami tiling;

(b) a tricolored domino covering.



## Tatami research

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- ▶ E, Ruskey, 2013, *Enumerating maximal tatami mat coverings of square grids with  $v$  vertical dominoes*.

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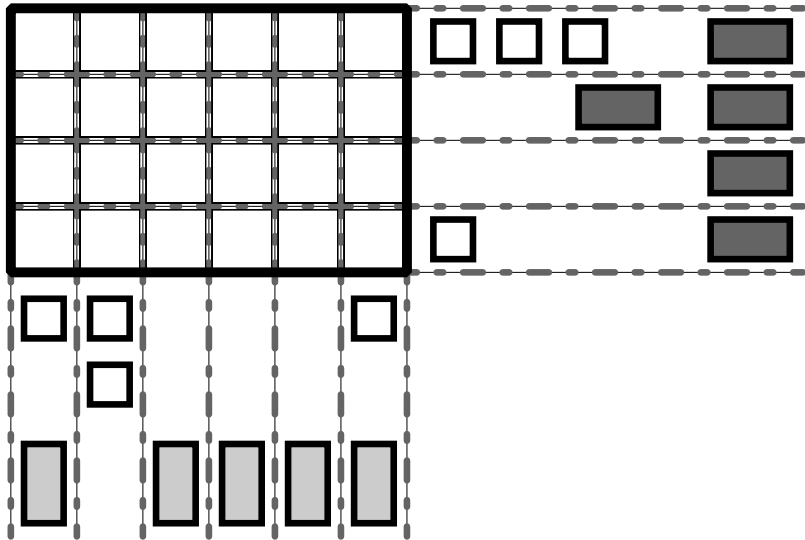
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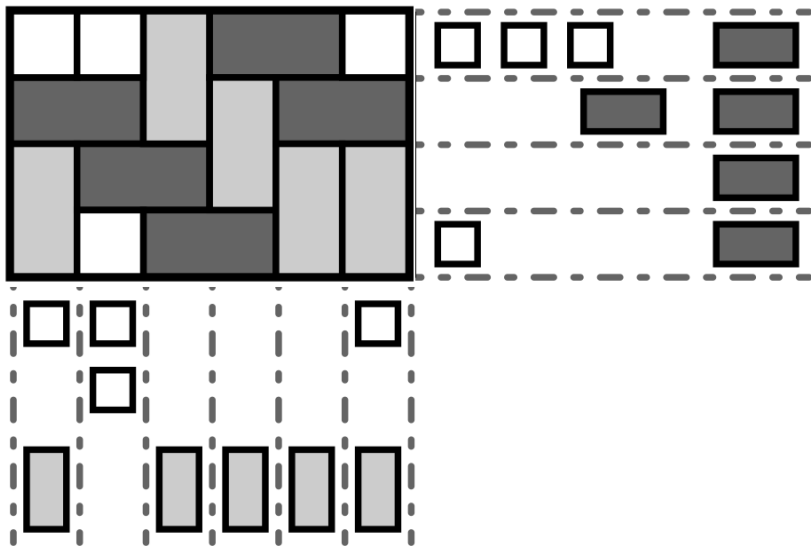
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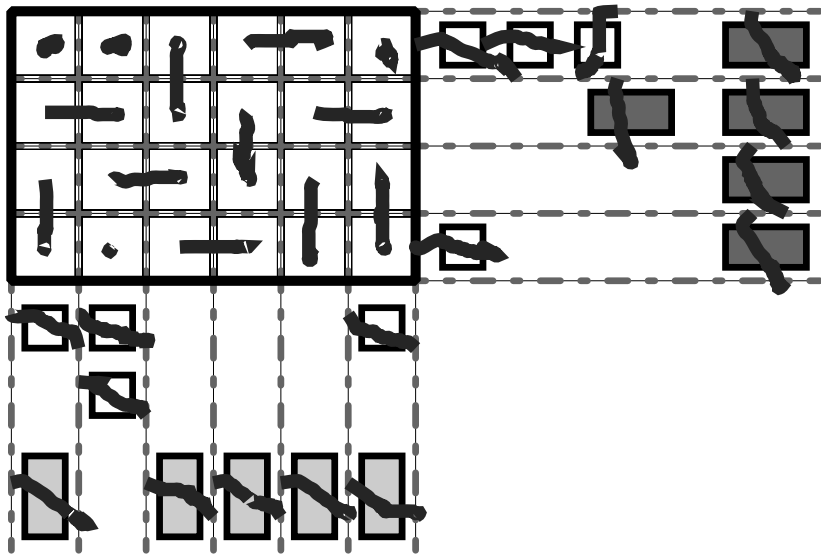
Tomoku!



Tomoku!



Tomoku!





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Pen-and-paper falls short

- ▶ Solution is not aesthetically appealing.

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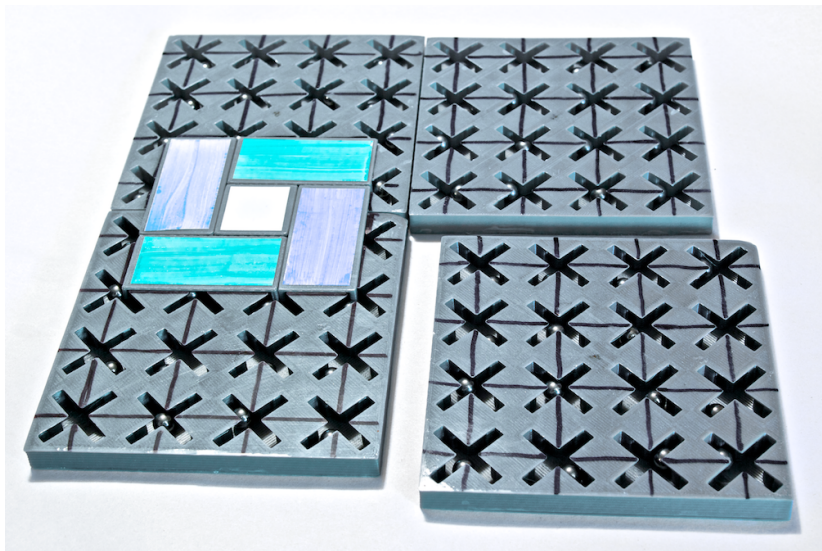
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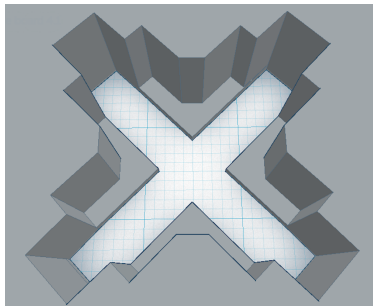
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- ▶ Solution is not aesthetically appealing.
- ▶ May require backtracking and erasing.
- ▶ Easy to forget the tatami restriction.
- ▶ Tatami Maker solves these problems.

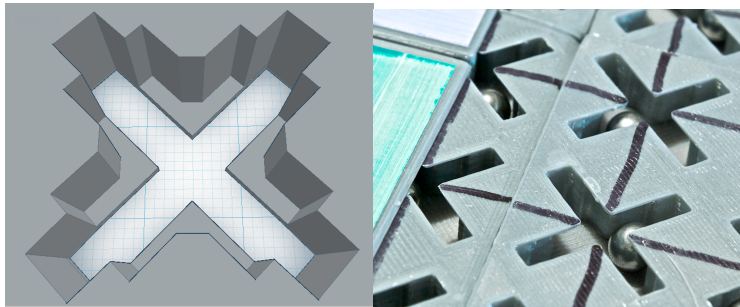
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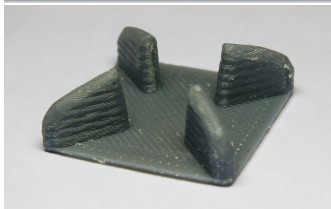
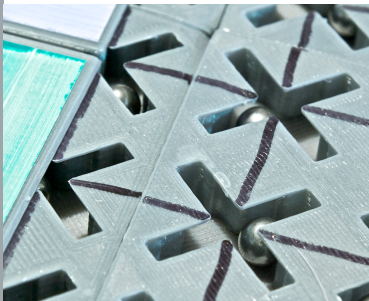
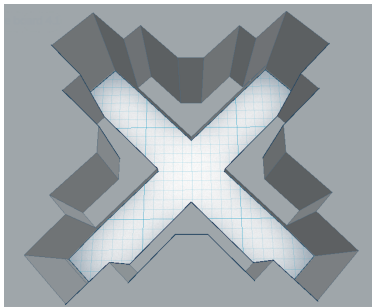
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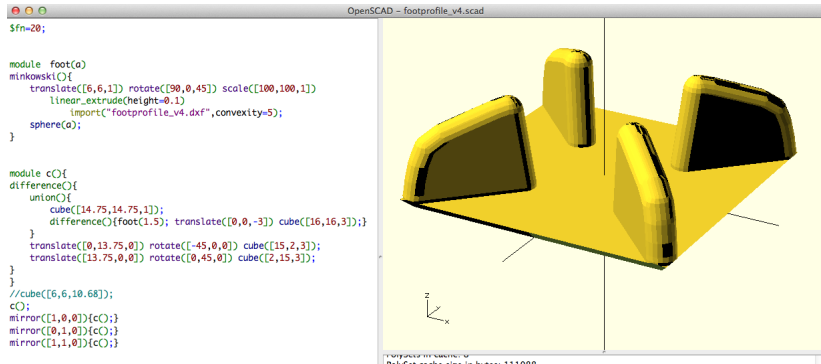


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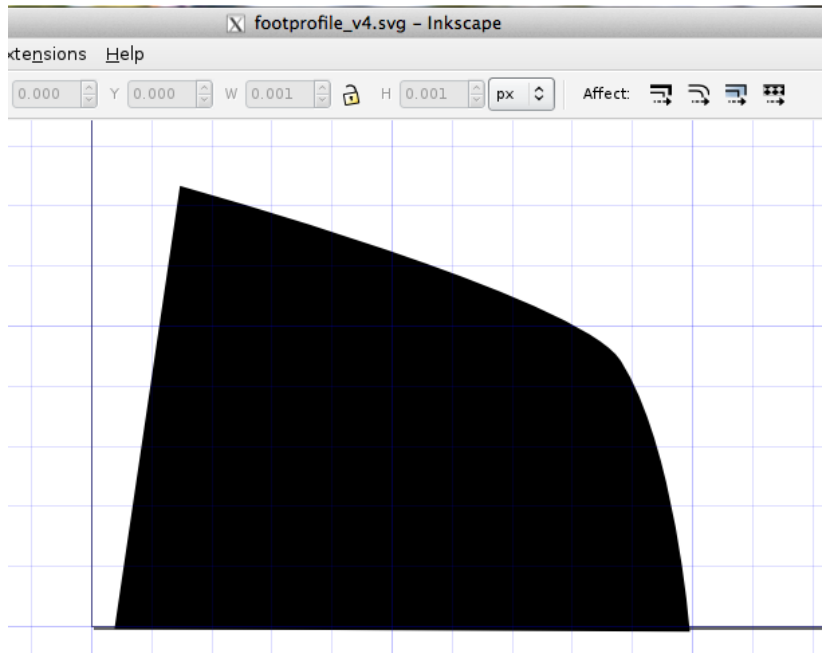




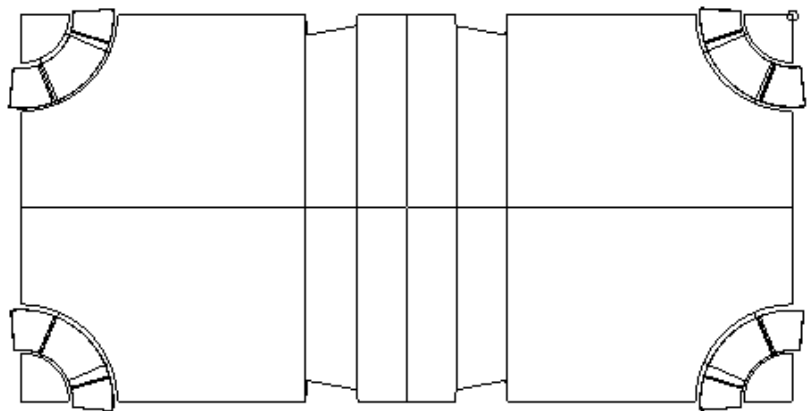
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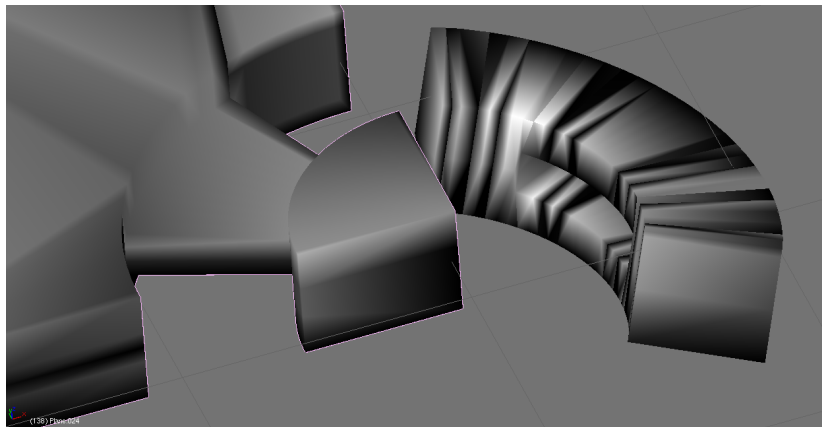
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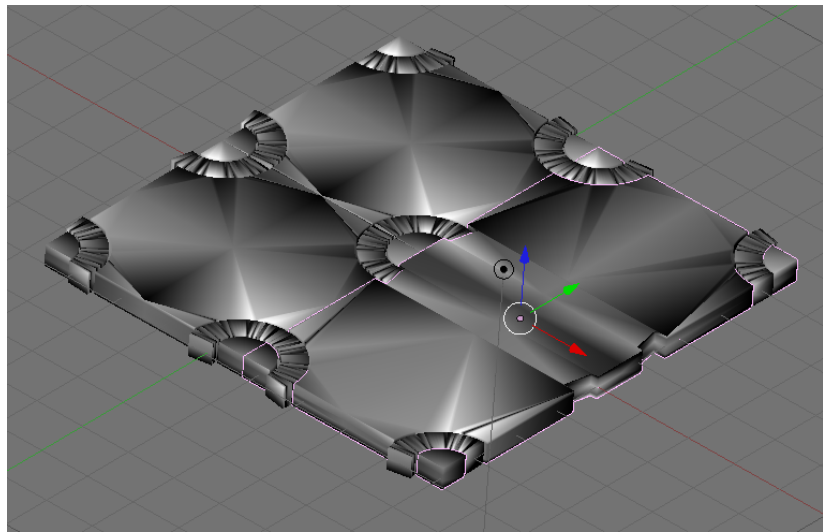
# Design iterations



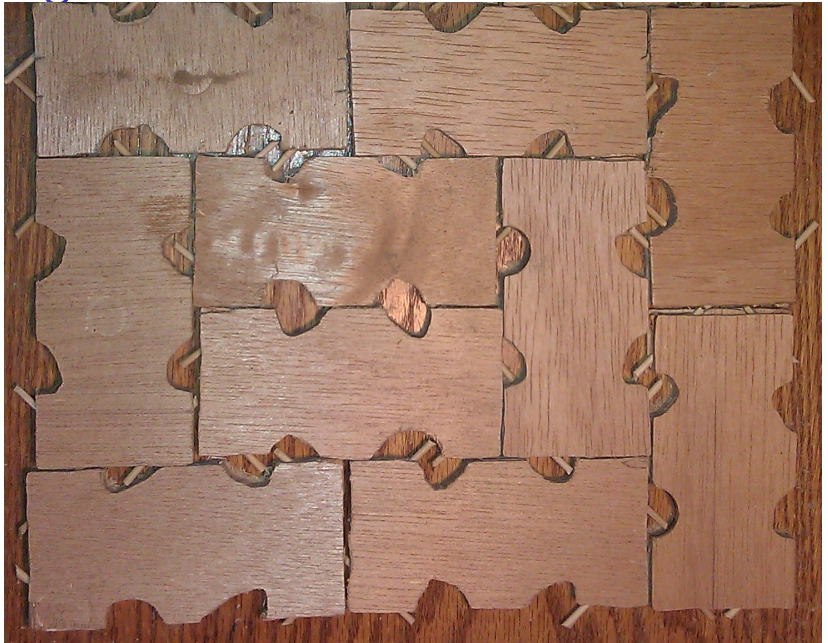
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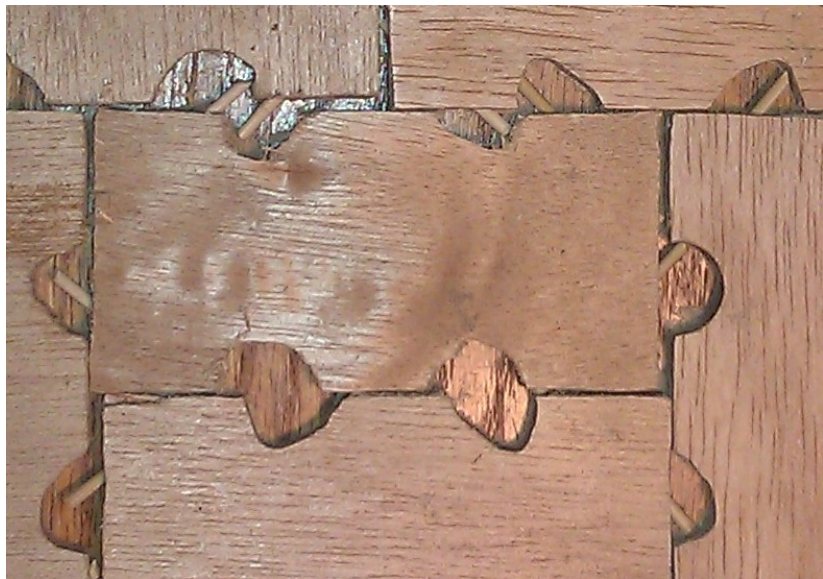
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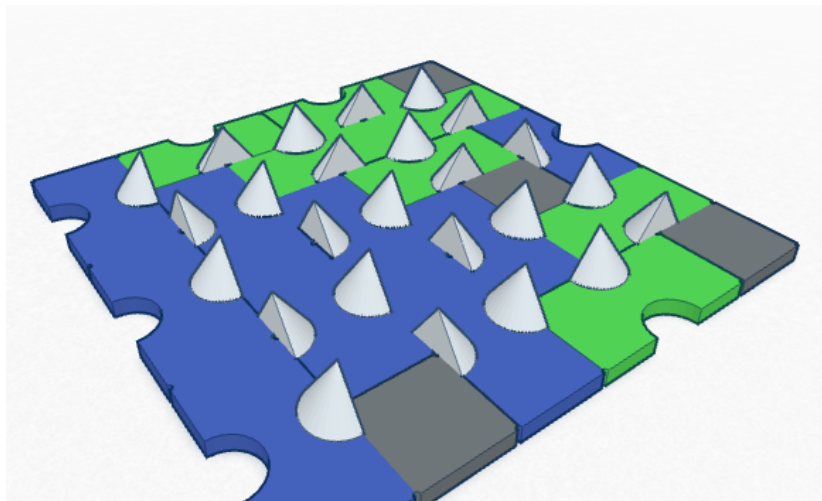
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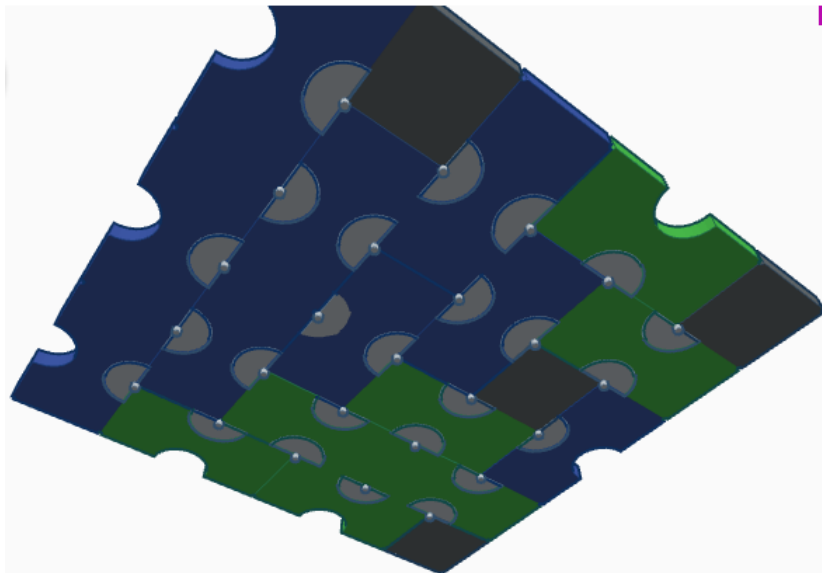


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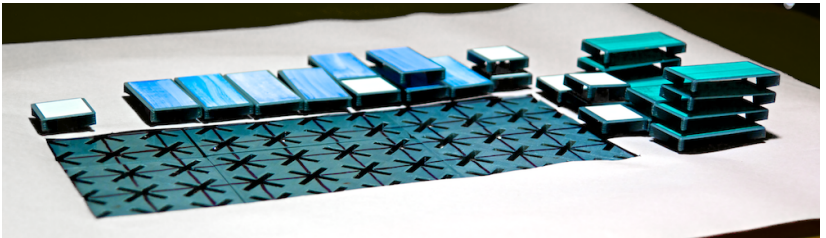


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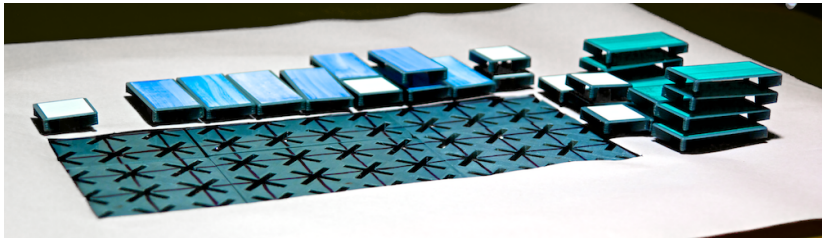
# Wish list

- ▶ Overcome the manufacturing flaws in the prototype.



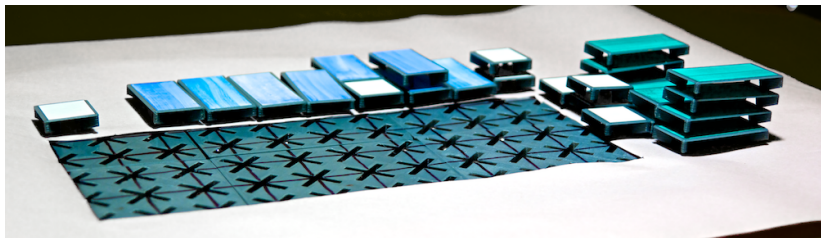
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- ▶ Perfect the overlays and game play.

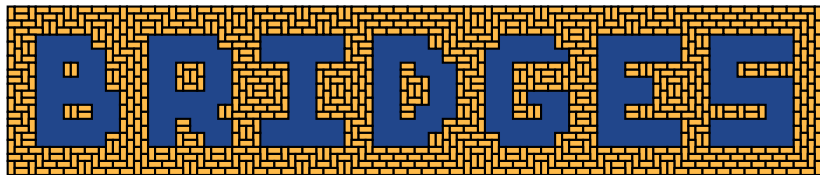


# Wish list

- ▶ Overcome the manufacturing flaws in the prototype.
- ▶ Perfect the overlays and game play.
- ▶ Patent Tatami Maker and publish a game?



Thank you



**Slides at** [alejandroerickson.com](http://alejandroerickson.com)