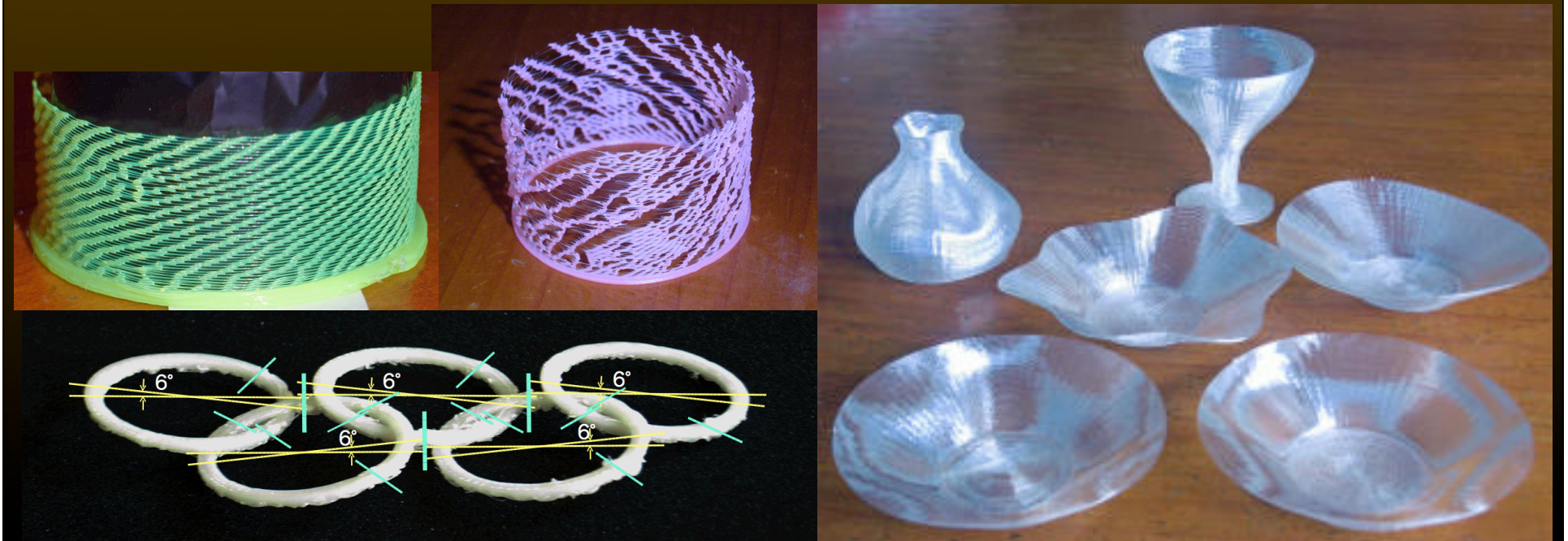


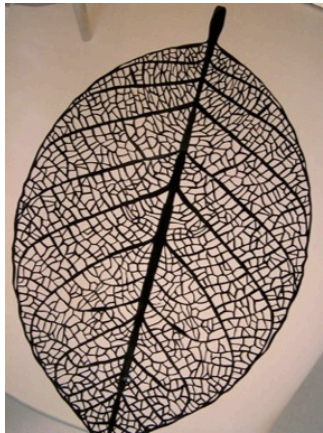
# Developing Revolutionary 3D Design and Printing Methods

Yasusi Kanada  
Dasyn.com, Japan



# Two Problems of Conventional 3D Design & Printing Methods

- ▶ **1. Conventional 3D models cannot express “direction”.**
  - Objects may have natural or artificial directions.



leaf vein



hair



? (plant)

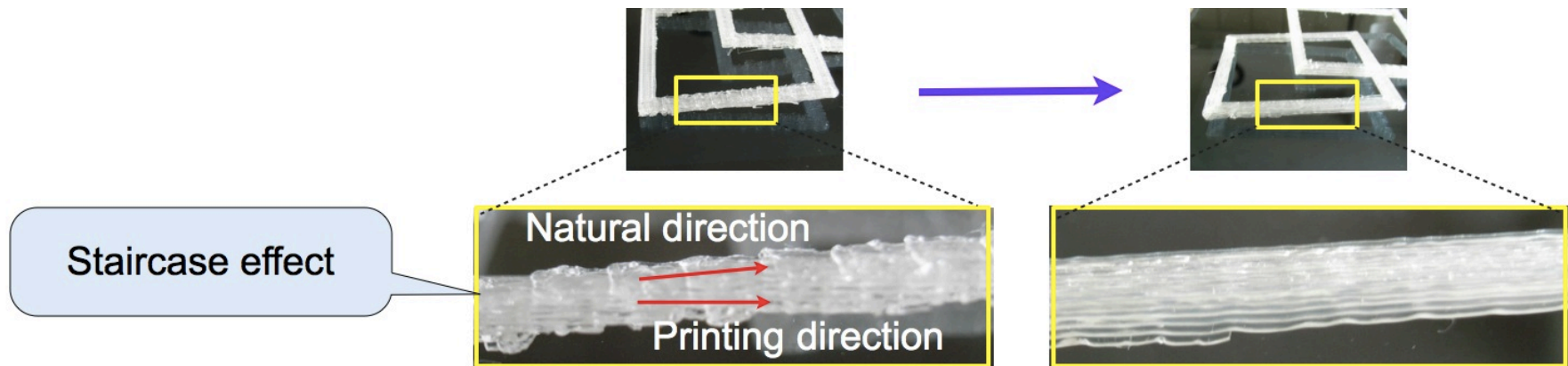


calligraphy

# Two Problems of Conventional 3D Design & Printing Methods (cont'd)

## ► 2. Conventional methods slice and print 3D objects only horizontally.

- Non-horizontal direction cannot be expressed.
- Especially, the printing direction of 3D printers may contradict with the “natural direction”.



# Newly Developed 3D Design & Printing Methods

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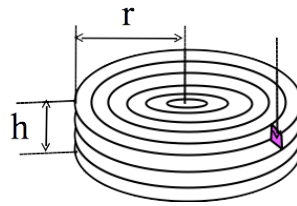
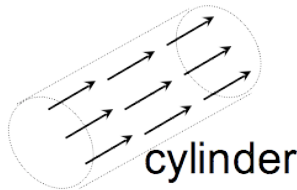
- ▶ **To solve the problems, we develop new 3D design and printing methods.**
- ▶ **These methods enable**
  - designing “real 3D objects” including the internal directed structures (not only surfaces).
  - printing patterns with non-horizontal directions.



# Three Methods to be Introduced

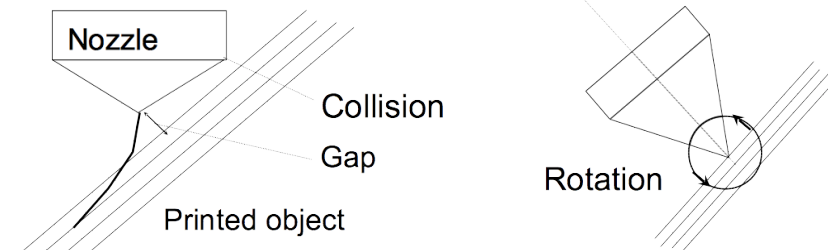
## ► 1. Direction-aware 3D *design* method

enables *designing* printing directions and shapes (both external/internal).



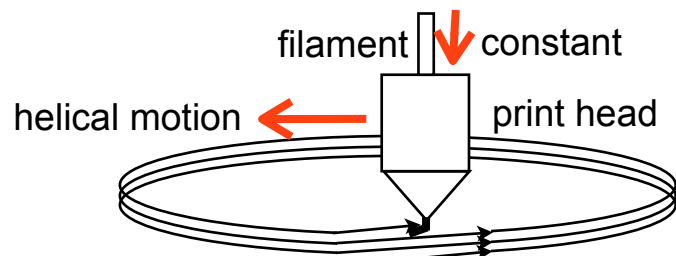
## ► 2. Non-horizontal 3D *printing* method

enables *printing* naturally-directed objects such as 3D calligraphies.



## ► 3. Self-organizing and naturally-randomized 3D printing method

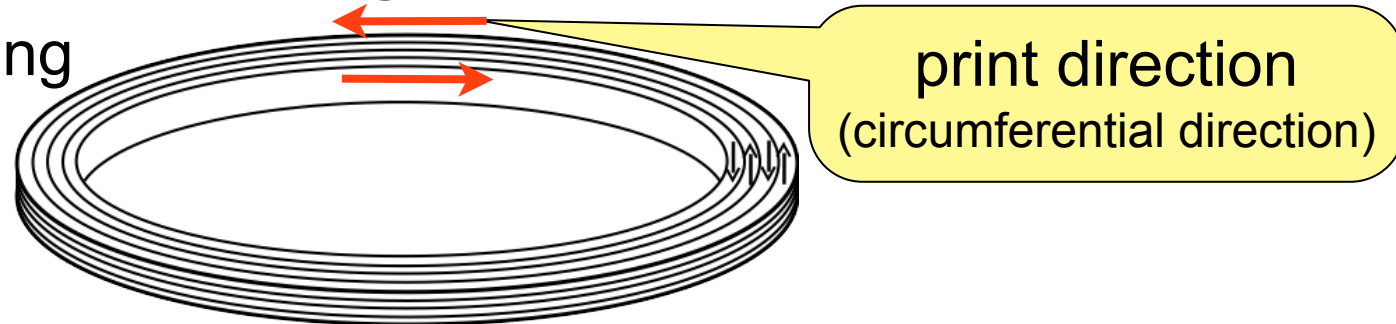
generates unexpected interesting 2D & 3D structures.



# Example: Olympic Symbol

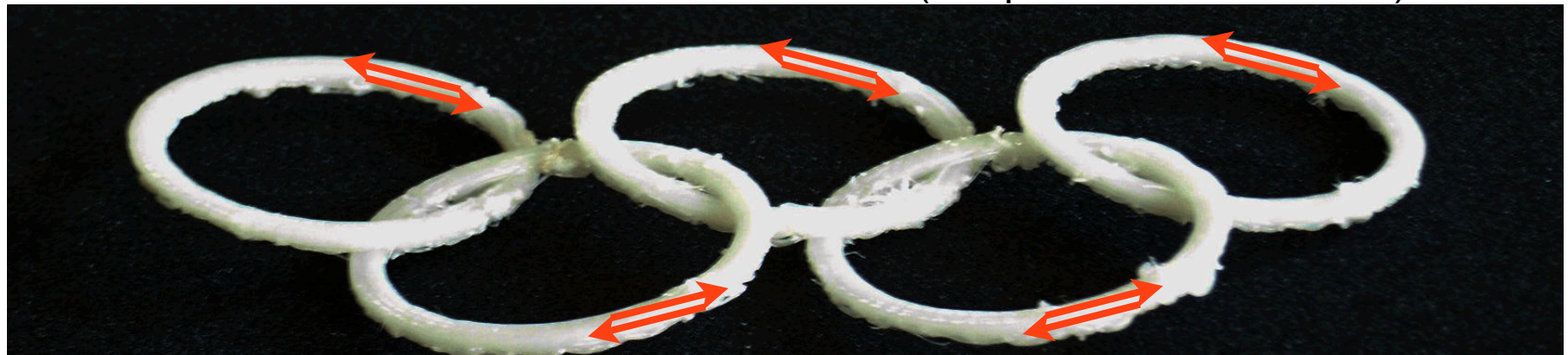
## ► Direction-aware design

Directed ring



Basic design technologies  
(partition, rotation, combination, ...)  
Basic printing technologies  
(Pat pend. P2013-161928)

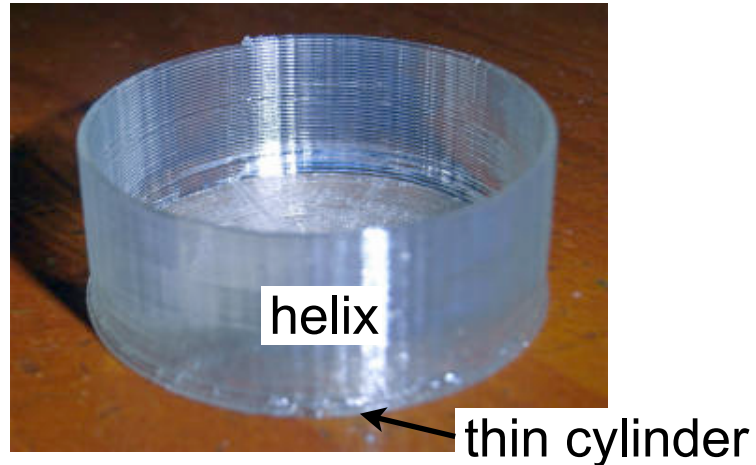
## ► Non-horizontal printing



YouTube, <http://youtu.be/saMdaqdlcxo> (1x ver), [FZZj6fGLIs0](http://youtu.be/FZZj6fGLIs0) (8x ver)  
or <http://www.dasyn.com/>

# Example: Dishes, Cups, Pods, and More ...

## ► Direction-aware design



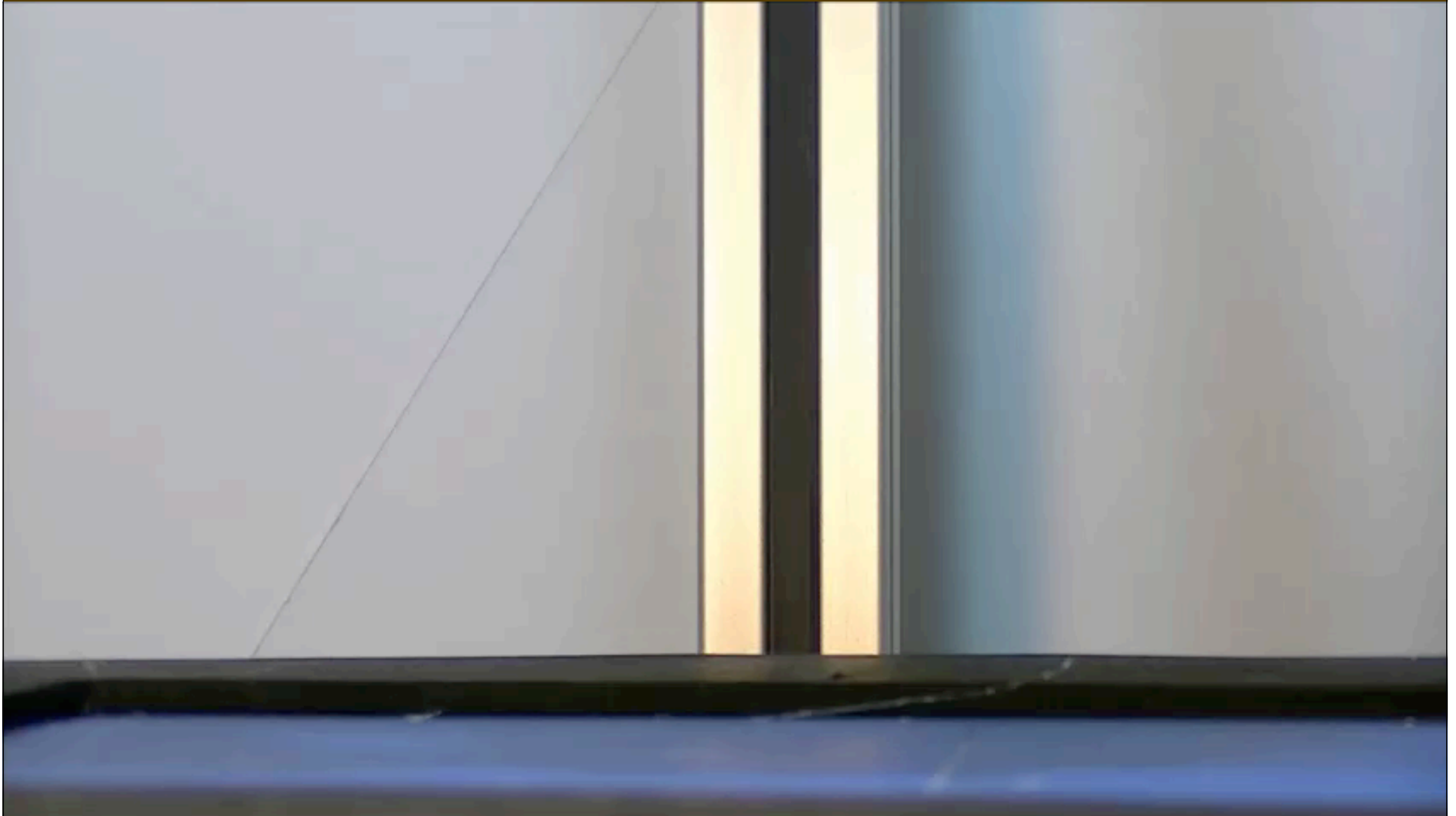
Advanced design  
technologies (deformation,  
light-reflection control)  
Advanced printing  
technologies

(Pat pend. P2014-118197,  
P2014-118200, P2014-126753)

## ► Non-horizontal printing



# Printing Process of Dish and Result

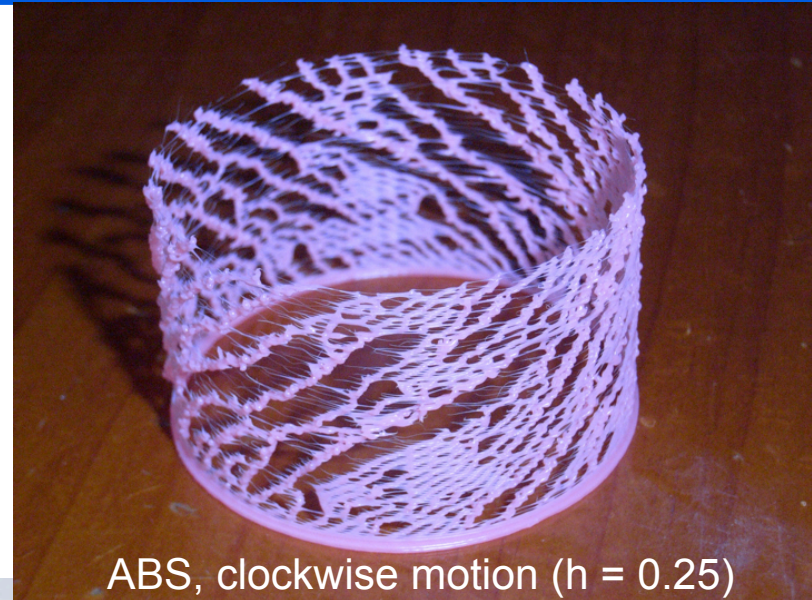
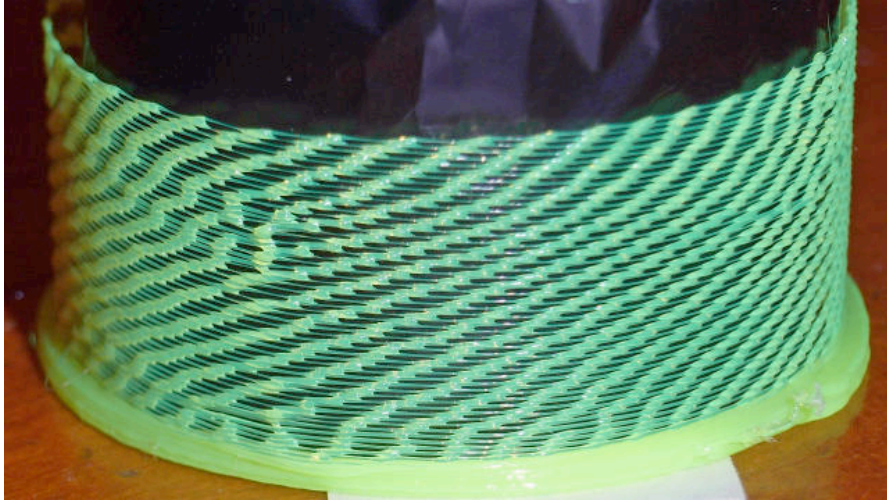


Uploaded soon to YouTube.

Preliminary version available at <http://www.dasyn.com/>



## Examples: Self-organizing and Naturally-randomized Printing (3rd method)



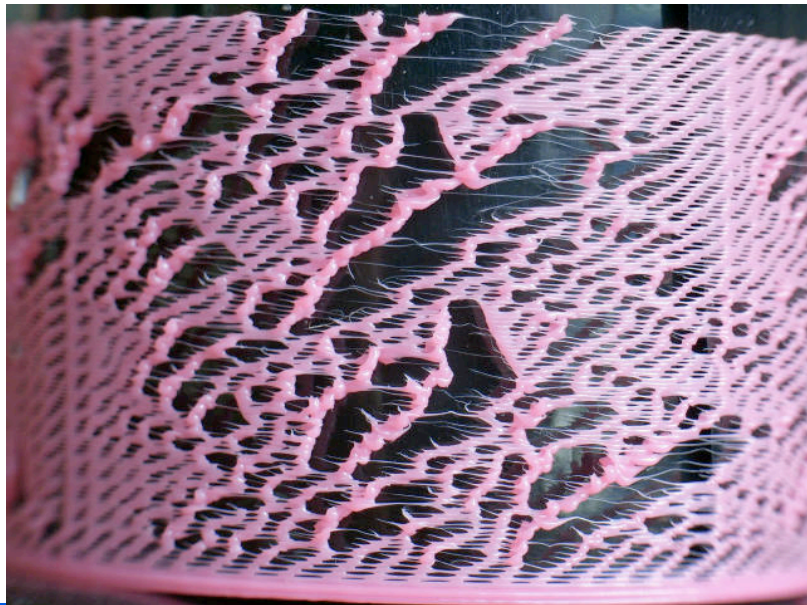
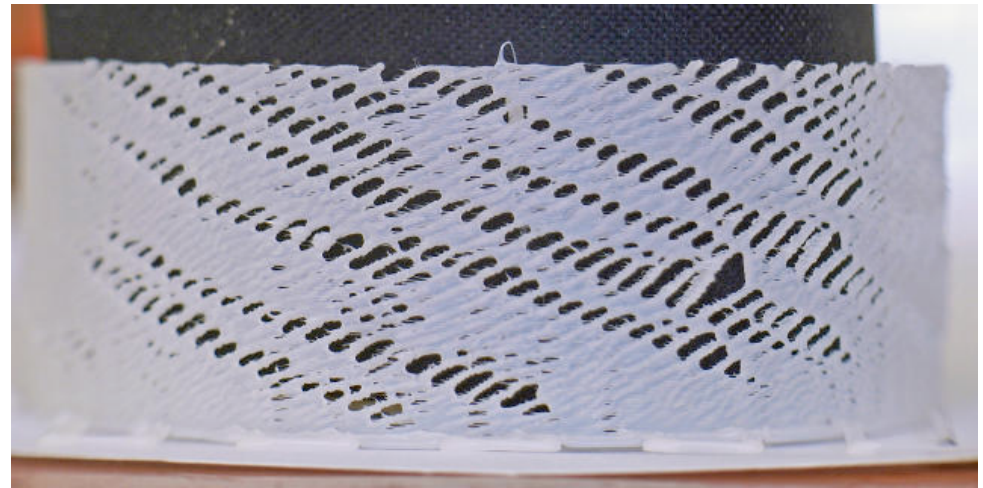
ABS, clockwise motion ( $h = 0.25$ )



PLA, clockwise motion ( $h = 0.15$ )



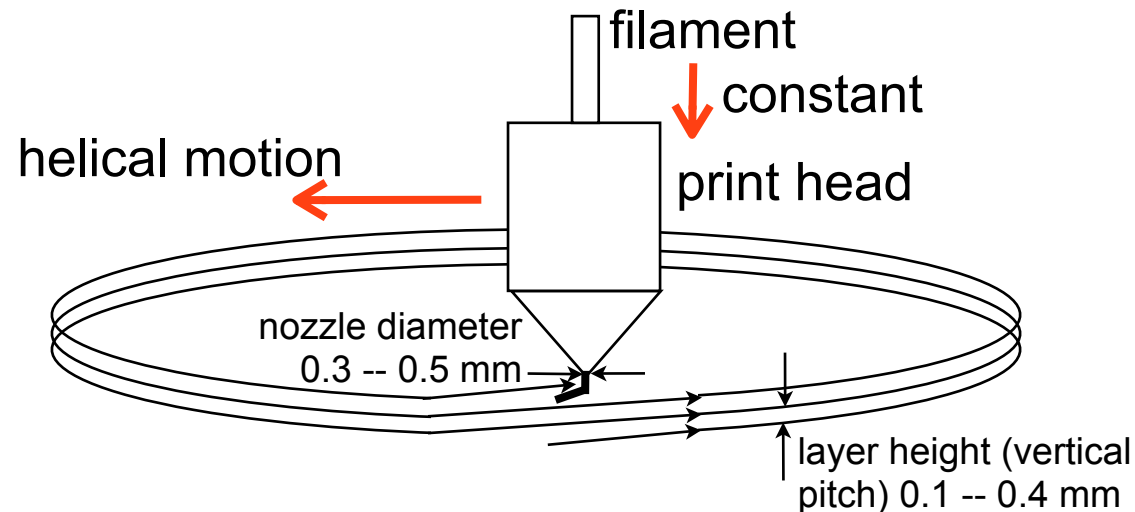
## Examples: Self-organizing and Naturally-randomized Printing (cont'd)



# Self-organizing and Naturally-randomized Printing

## ► Self-organized patterns can be generated by

- Constant helical head motion
- Constant extrusion of filament
- Small amount of filament





# Printing Process of Self-organizing Pattern using Rostock MAX 3D printer



YouTube, <http://youtu.be/IJ15ysJR5l8>  
or <http://www.dasyn.com/>



# Potential Applications

## ► Generative art (Algorithmic art)



calligraphy

## ► 3D Calligraphy



Julien Breton



立体象書研究会

- Directed 3D calligraphy  
3D printing based

?

Iron based



Shishu

# Summary and Conclusion

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► **Three revolutionary 3D design & printing methods are proposed.**

- 1. Direction-aware 3D design method
- 2. Non-horizontal 3D printing method
- 3. Self-organizing and naturally-randomized 3D printing method

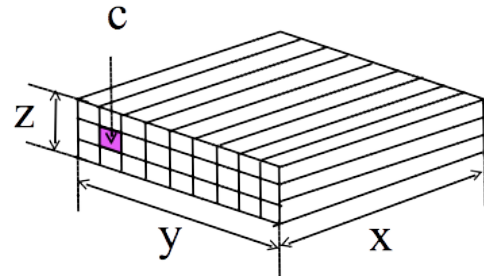
► **We seek partners who will collaborate and develop applications of these methods.**

- Information available on Web: **[www.dasyn.com](http://www.dasyn.com)**.
- You can see and get print samples.

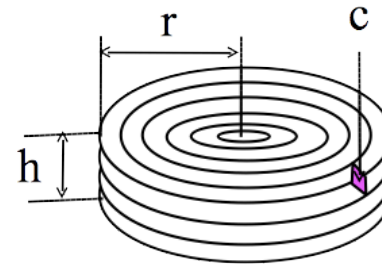
# Appendix: 1. Direction-aware 3D Design Method

- Parts for 3D CAD are “hashed” (or “peeled”) in this method.

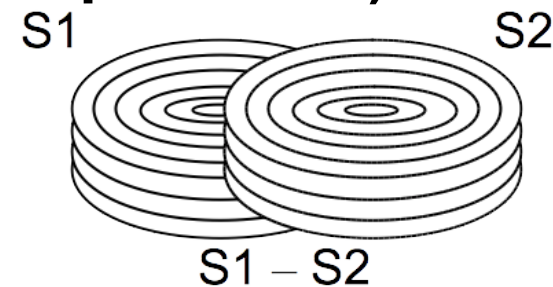
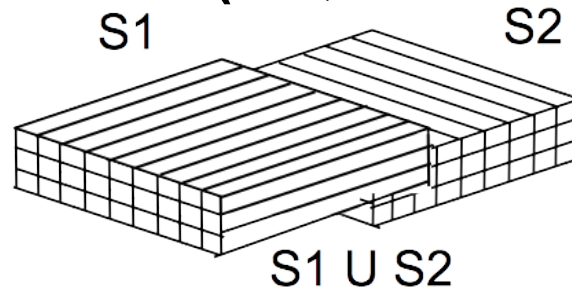
Cross section



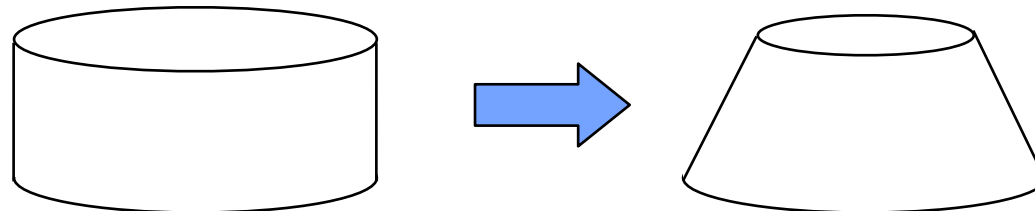
Cross section



- Parts are combined by using operations such as union or intersection (i.e., extended set operations).

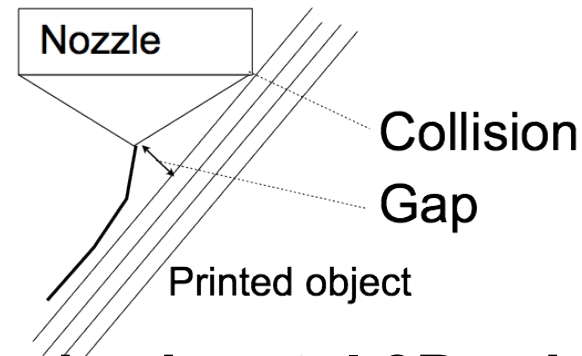


- Parts may be “deformed” to generate more complex shapes.



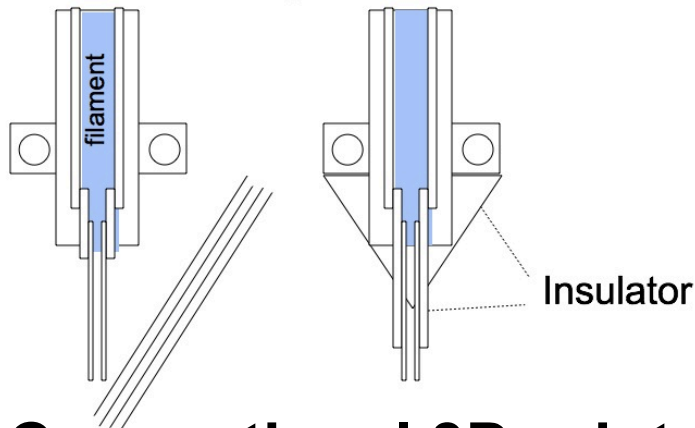
## Appendix: 2. Non-horizontal 3D printing method

### ► Problems in steep printing

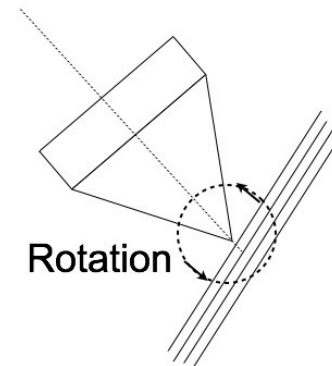


### ► Conceptual methods for non-horizontal 3D printing.

- Needle-shaped nozzle



- Five-axis print-head



### ► Conventional 3D printers are not the best but work.

- Delta-type printers, such as Rostock MAX, →

