STEAM Education Enriching Knowledge Series: “3D Printing x Innovative Eyewear Development” Design Thinking Workshop (New)

HKPC Academy

27 June 2023, 14:30 – 17:30

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Trends of 3D printing Technology & Related Application in Product Development (3D打印技術趨勢與相關產品開發應用)

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Smart Manufacturing Division
Hong Kong Productivity Council

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3D打印

3D打印技術趨勢

- 3D產品成型之概念發展
- 從設計至建立模型

於產品開發的相關應用

- 3D打印於不同行業的應用
- 傳統製造生產與直接製造的比較
- 參觀及體驗先進3D打印與直接製造中心及樣品

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3D打印

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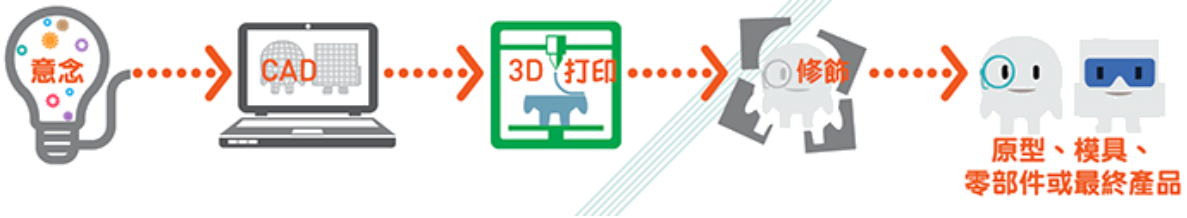
什麼是3D列印?



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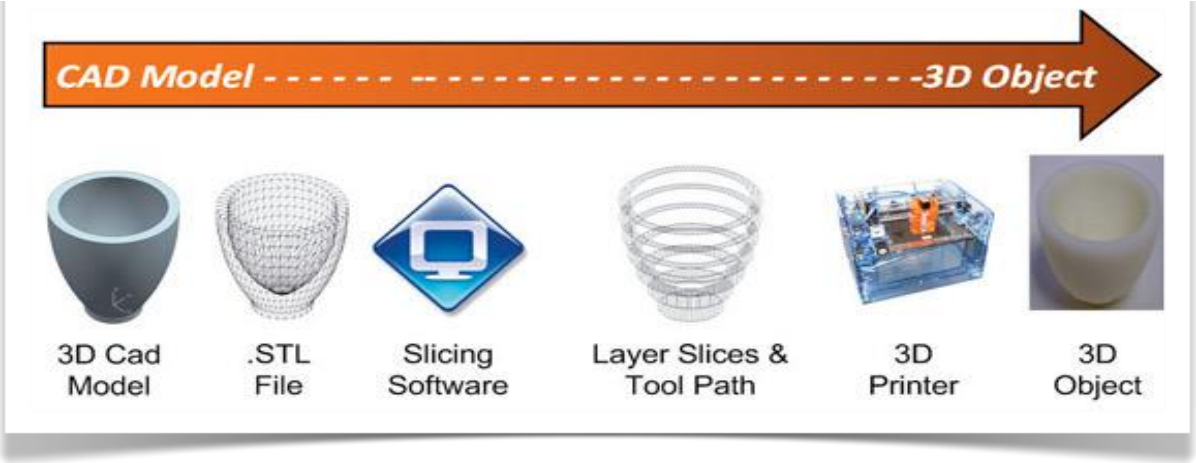
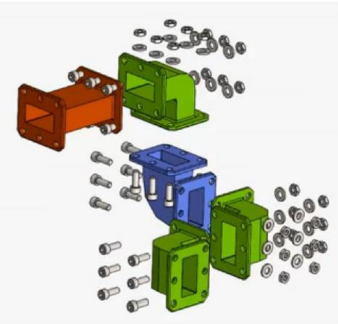
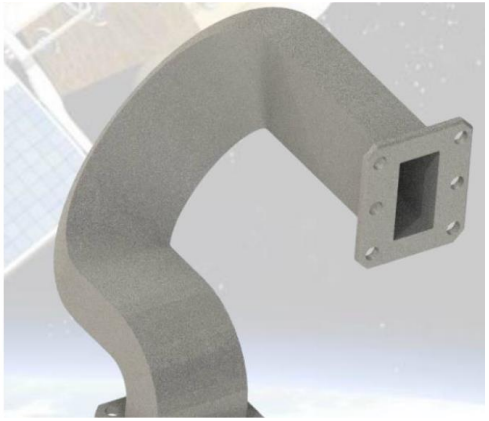
3D 列印優勢：節省材料浪費及加工時間


CAD Model - - -

3D 列印優勢



Single piece microwave guide reduces weight and improves performance



零件整合

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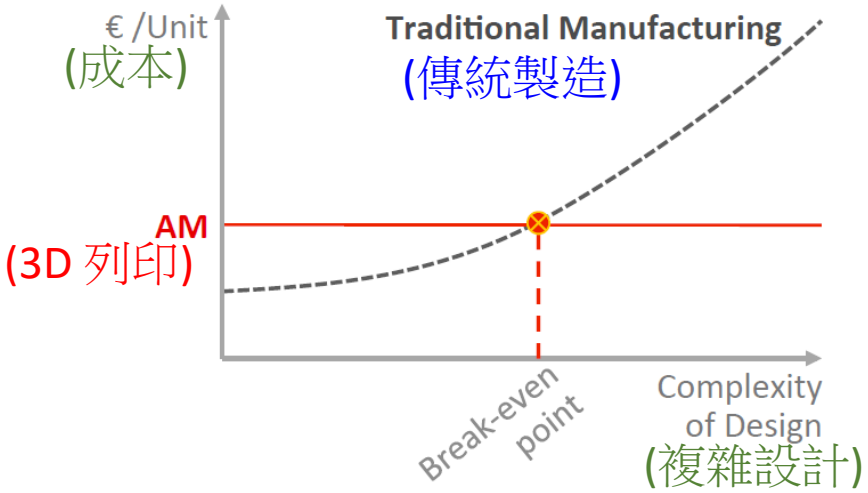
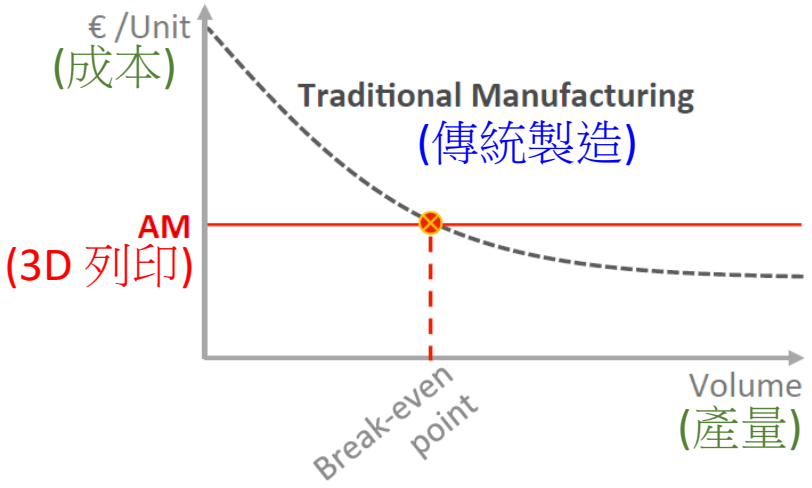
傳統製造 VS 3D 列印

Complexity advantage (複雜結構)



Strong cost advantage for complex components

Volume advantage (產量)



Strong cost advantage for small volume production

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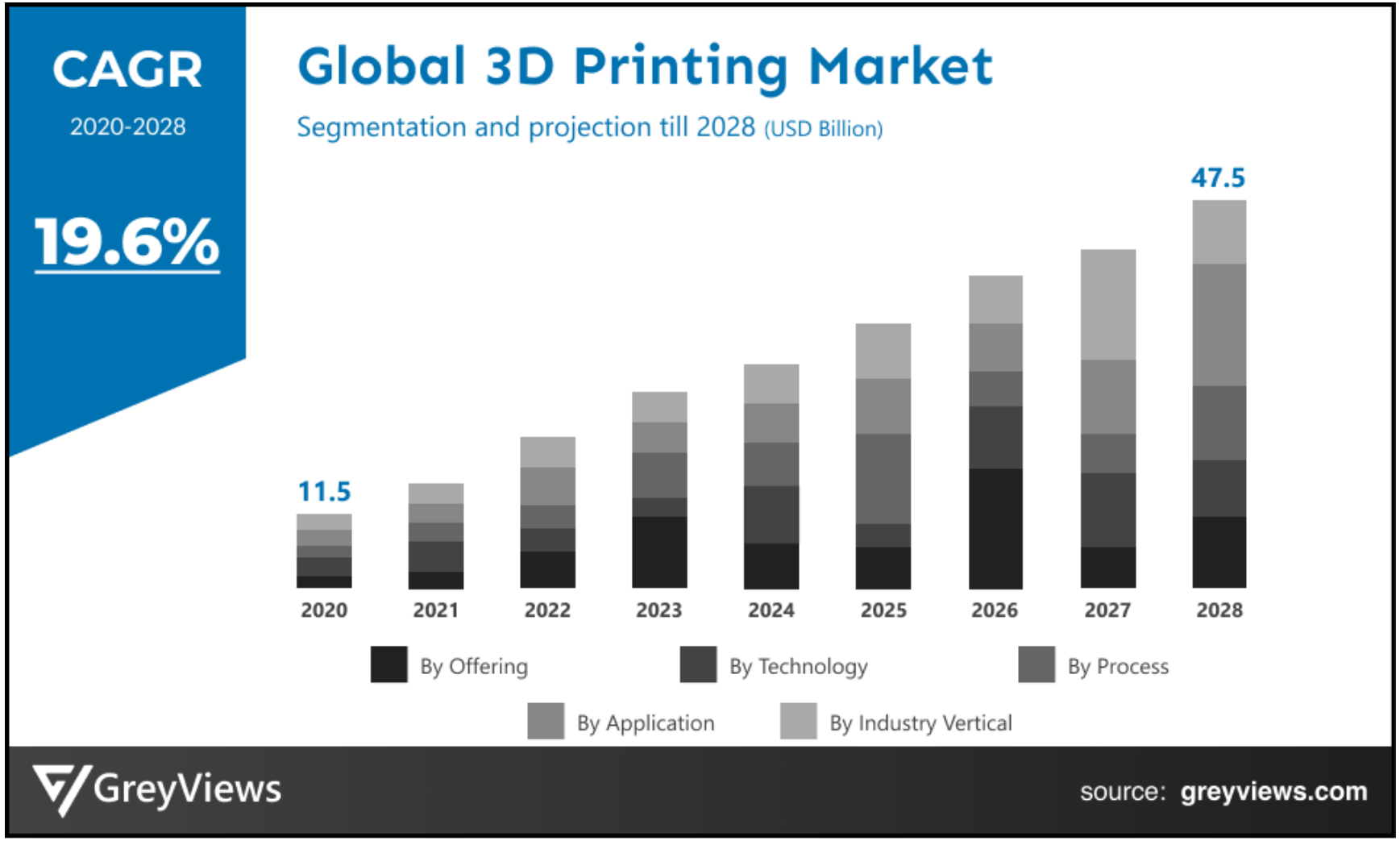
3D打印行業市場規模



據GreyViews預計到2028年將達到470.5億美元 (3,669.9億港元)

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3D列印技術應用企業

Source : EOS

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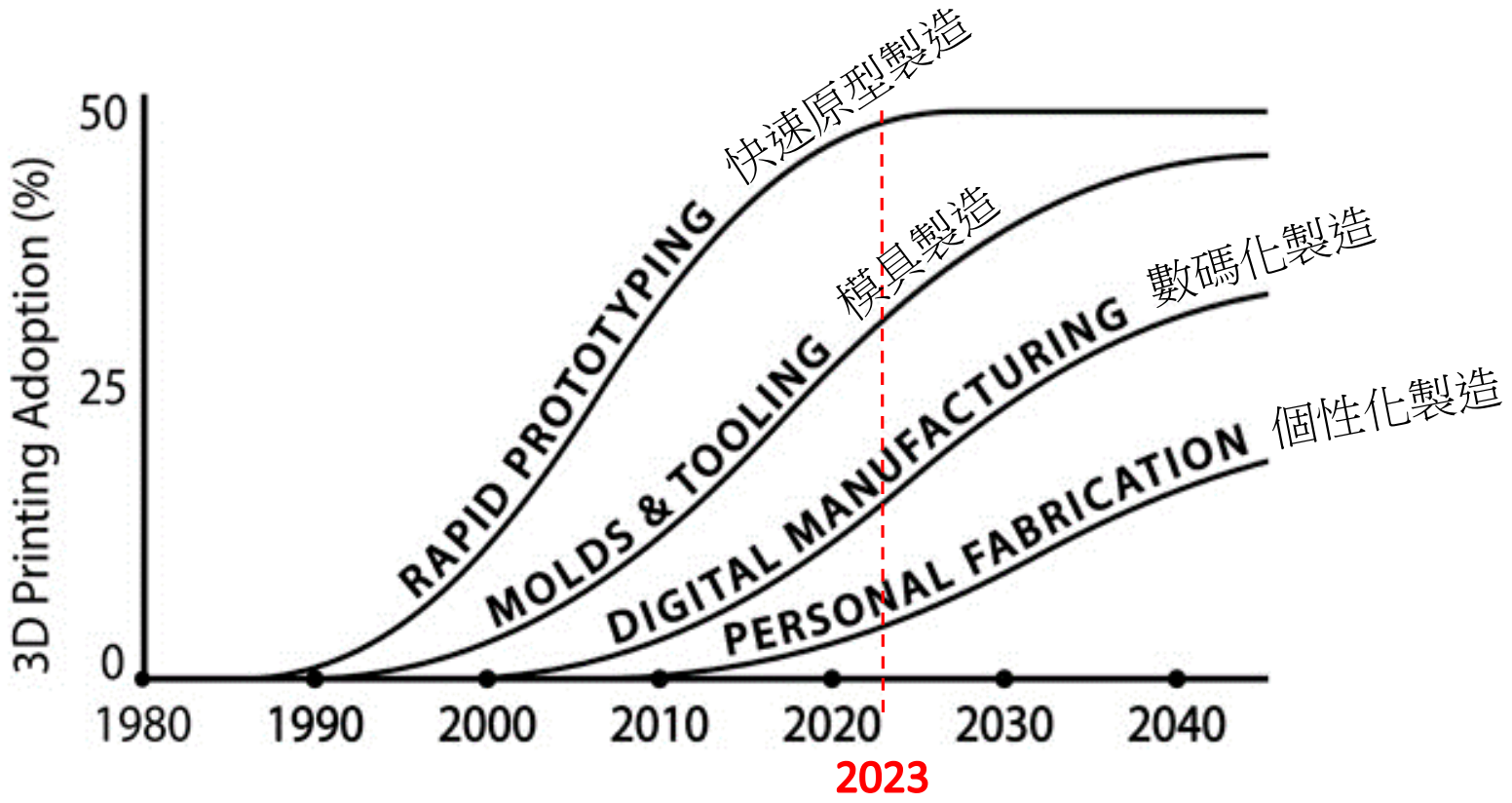
3D 列印 - 採用程度



"3D printing: Second edition" by Christopher Barnatt

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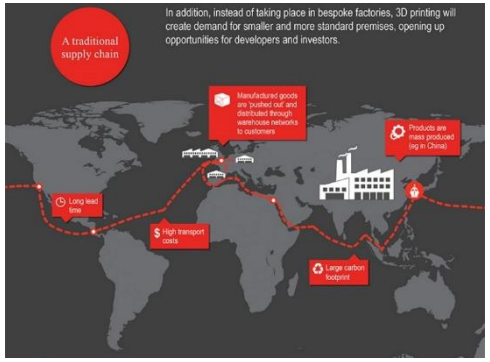
為什麼要發展3D打印？

- 分散式製造：增量製造與雲端運算技術結合，使系統或地理上的分散化生產成為可能。一些企業已經在進行此類分散式製造，有些還提供為3D打印商與客戶牽線的服務。



大規模客製化：3D打印公司提供客製化服務，客戶只需使用簡單的網頁客製化軟件即可客製化特殊的3D物體。例如，寶馬Mini推出了個性化設計的配件，消費者可以設計自己的配件。未來可能連傢俱這種大型物品都能這樣製作出來。

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為什麼要發展3D打印？

- 快速製造：快速生產引入了可用於最終生產的原料，從而使直接生產零部件成品成為可能。3D打印給快速生產帶來的一個好處就是可以降低少量零部件的生產成本。

快速成型：20世紀80年代早期工業印表機就已經存在，並廣泛地應用於快速成型和學術研究當中。這種印表機體積較大，使用特殊的金屬粉末，鑄模媒介（沙粒等），塑料，紙張和墨盒，應用於大學和商業機構的快速成型實踐當中。

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3D打印物料種類

- 3D打印物料
  - 金屬
    - 不鏽鋼
    - 鈦合金
    - 馬時體時效鋼
  - 塑膠
    - 聚乳酸(PLA)
    - ABS樹脂
    - 尼龍(PA12)
  - 陶瓷
    - 氧化鋯
    - 氧化鋁
  - 複合材料
    - 仿木料
    - 仿金屬材料

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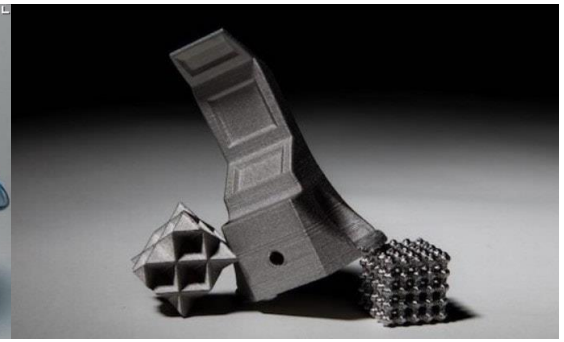
3D打印物料：金屬

例子	不鏽鋼316L	馬時體時效鋼
性質	作為316鋼種的低碳系列，除與316鋼有相同的特性外，其抗腐蝕性優	特別的低碳超高強度鋼，其高強度並不來自於碳，而是來自於數種金屬化合物，其中的主要合金元素為15%到20%的鎳
性能	堅韌，可實現低彎曲半徑和捲軸而不會斷裂	抗腐蝕性能良好，高強度硬度
應用	汽車零部件	隨形冷卻水路模具



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3D打印物料：塑膠

例子	PLA	ABS樹脂
性質	以玉米為主的材料，是一種热塑性脂肪族聚酯	熱塑型高分子材料
性能	有光澤，收縮率相對較低，堅硬較脆，熔點低	堅硬，韌性較高，容易作表面處理，收縮率較高，需要加熱平台減少模形低部翹邊或收縮情況
應用	原型製造	原型製造， 產品開發階段之功能性測試

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3D打印物料：陶瓷

例子	氧化鋯	氧化鋁
性質	鋯的主要氧化物，通常狀況下為白色無臭無味晶體，難溶於水、鹽酸和稀硫酸	鋁的氧化物，一種白色固體
性能	高強度，韌性好，抗腐蝕性能好	耐磨，抗腐蝕性能好
應用	人造牙，鐘錶或裝飾品	研磨材料

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3D打印物料：複合材料

例子	仿木料	仿金屬料
性質	混入了一定比例木粉的PLA材料	PLA材料加入相當比例的金屬粉末
性能	質感及顏色類似木材，打印後需完全清除仿木料，否則有可能導致噴頭堵塞	提升受熱效率
應用	雕塑	道具，服裝配件

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3D打印技術種類

- 3D打印技術
  - 擠壓型
    - 熔融沉積成型(FDM)
  - 粉末型
    - 直接金屬激光燒結(DMLS)
    - 選擇性激光燒結(SLS)
    - 光射流熔融3D打印(Jet Fusion)
  - 光聚合型
    - 感光樹脂成型(SLA)
    - 光敏聚合物噴射(PolyJet)
  - 層積型
    - 堆疊黏貼成型(LOM)

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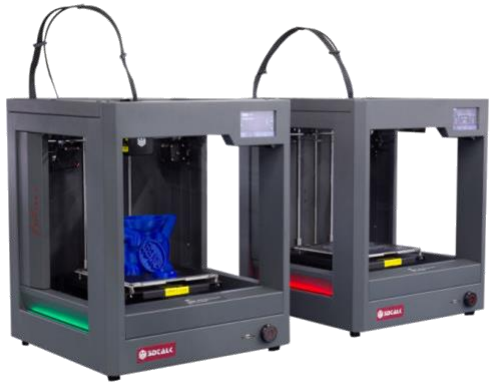
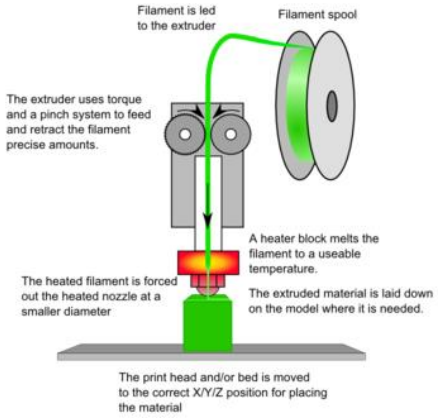
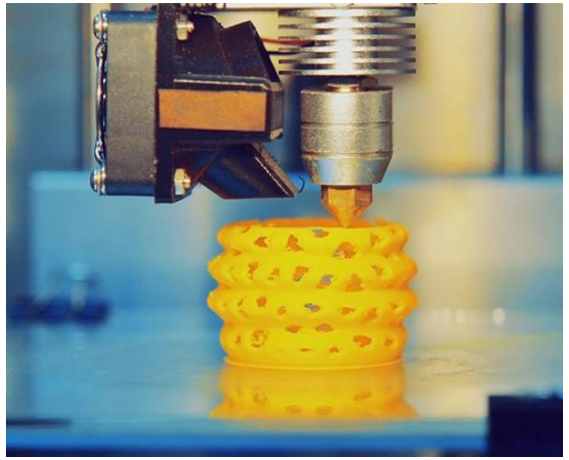
3D打印技術：擠壓型

技術原理	利用高溫將材料融化成液態，通過打印頭擠出後固化
優點	設備、材料價格便宜、易用
缺點	成型慢、精度低
例子	熔融沉積成型(FDM)： - 像「擠忌廉」，透過一個熱咀把打印材料（PLA、ABS和尼龍等）熔化，一層疊一層擠出來，固化成型







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3D打印技術：擠壓型

- 應用FDM技術製作眼鏡

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工業級3D打印機例子

- Industrial FDM 3D Printer
  - Single color (Ivory, White, Black, Dark gray, Red, Blue)
  - 單色 (象牙白, 白色, 黑色, 深灰色, 紅色, 藍色)
  - Materials: PC/ABS 物料
  - Support Soluble Support Material 支援水溶性支撐物料
  - Fine layer 精細打印效果
  - 最大可加工尺寸: 400 x 350 x 400mm
  - 精確度: +/- 0.12mm/0.17mm/0.25mm
- 應用：
  - Rapid Prototype 快速原型製造
  - Small batch production 小批量生產
  - Functional testing in R&D Stage 用於產品開發階段之功能性測試

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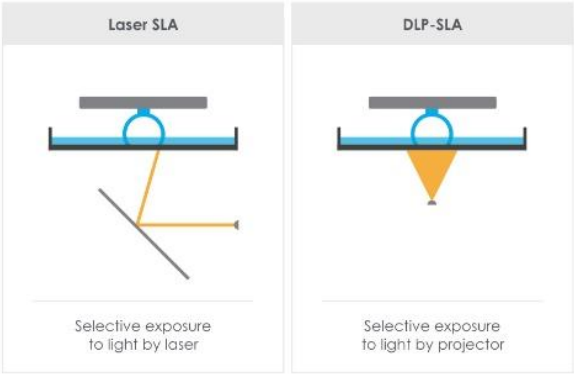
3D打印技術：光聚合型

技術原理	利用液態光敏樹脂等材料在紫外光照射下，快速固化成型
優點	成型精度高、速度快、表面光滑
缺點	材料相對昂貴
例子	光敏聚合成型 (SLA) / (DLP)



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桌面級3D打印機例子

光聚合型成型打印機（光固化立體成型技術）：

- 精細打印效果
- 表面光潔度高
- Materials: Resin 光固化樹脂
- 最大可加工尺寸: 145 x 145 x 185mm
- 精確度: +/- 0.003mm/0.003mm/0.003mm

應用：

- 原型製造
- 珠寶首飾蠟辦

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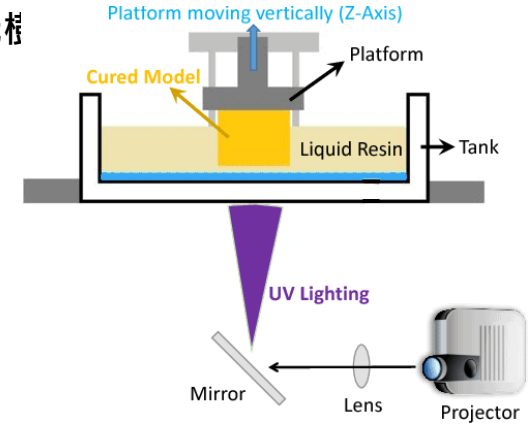
工業級3D打印機例子

Stereolithography (SLA)
(感光樹脂成型技術)

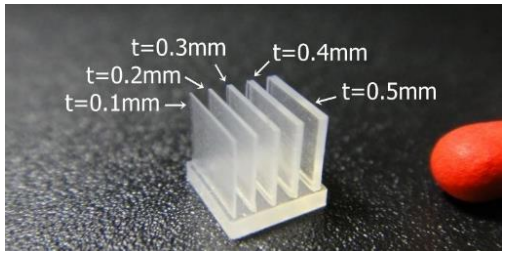
EnvisionTEC., Perfactory® SXGA+ Standard Zoom 3D Printer

- Materials: **Photocurable Resin/ Wax / EnvisionTEC eShell 200 photocurable polymer (Biomaterial) 光固化樹**
- **Fine layer 精細列印效果**
- **Smooth Surface 光滑表面**
- **最大可加工尺寸:** 90 x 90 x 160mm
- **精確度:** +/- 0.025mm



Application 應用:

- Rapid Prototype **快速原型製造**
- Lost wax casting **失蠟鑄造**
- Small batch production **小批量生產**
- Jewelry **珠寶首飾蠟辦**



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工業級3D打印機例子

Stereolithography (SLA)
(感光樹脂成型技術)

- 應用SLA技術于金飾模型製作及失蠟鑄造

「蟠龍獻瑞」純金擺件

HKPC 協助業界成功案例

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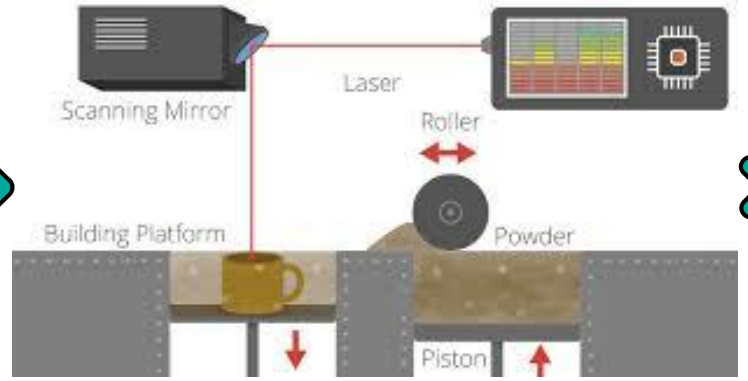
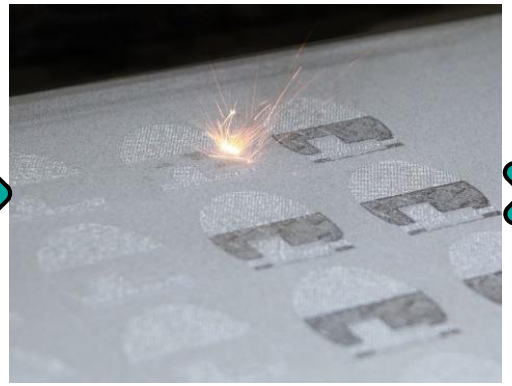
3D打印技術：粉末型

技術原理	利用激光或電子束等熱能，將材料粉末連接成型
優點	適用多種材料 (例如: 塑料、金屬)
缺點	設備昂貴、打印環境要求高
例子	選擇性激光燒結(SLS)： - 利用粉末材料在激光照射下高溫燒結的基本原理，通過計算機控制光源定位裝置實現精確定位，然後逐層燒結堆積成型 - 主要應用於製造內藏複雜冷卻水道的模具，亦適合打印高增值產品，包括汽車配件、醫療器械等





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3D打印技術：粉末型

Selective Laser Sintering (SLS)
(選擇性鐳射燒結技術)

Sodick OPM250L Metal 3D Printer

- Metal 3D Printing 金屬3D 列印
- Materials: Maraging steel 馬氏體時效鋼
  (相當於420SS不銹鋼)
- Hybrid Metal 3D Printing
  鐳射造型複合加工（鐳射造型+高速切削加工）
- Density up to 99.97%, HRC 50 (After heat Treatment)
  溶融密度為99.97%以上，硬度可達HRC50以上
- 最大可加工尺寸: 250 x 250 x 250mm
- 精確度: 0.01 - 0.02mm

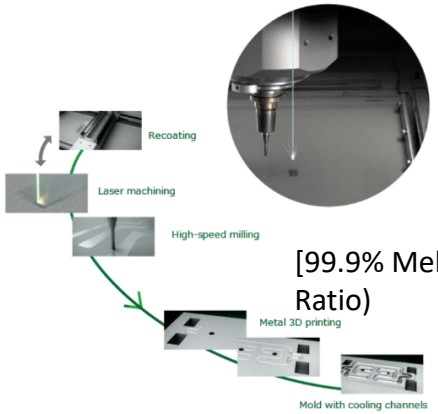
塗金屬粉末

激光燒結

精加工

Application 應用:

- Conformal Cooling Tooling inserts 隨形冷卻模具工件
- Automotive part 汽車零部件
- Aerospace part 航空零部件
- Metal prototype 金屬原型
- Small batch production 小批量生產



[99.9% Melting Ratio)

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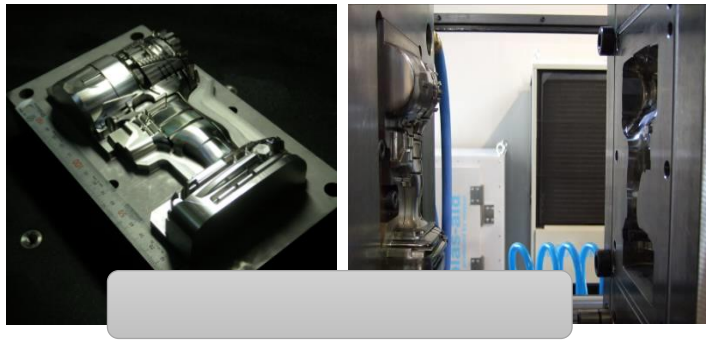
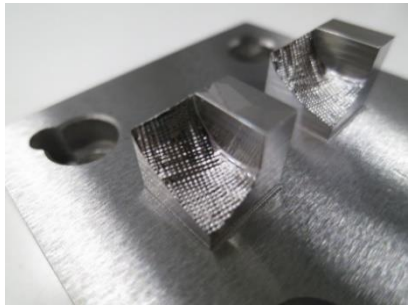
3D打印技術：粉末型

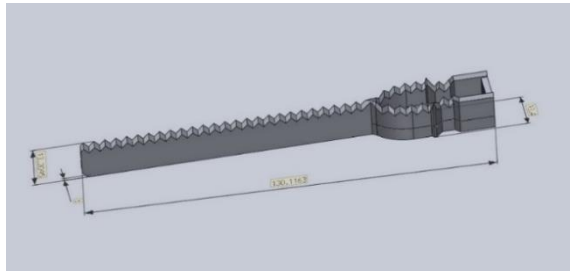
Selective Laser Sintering (SLS)
(選擇性鐳射燒結技術)
HKPC 實際案例



應用案例: 隨形冷卻模具



應用案例: 服裝紋理模具



應用案例: 食品包裝刀具

應用案例: 鐘錶外殼

應用案例: 定制夾具

HKPC 協助業界成功案例

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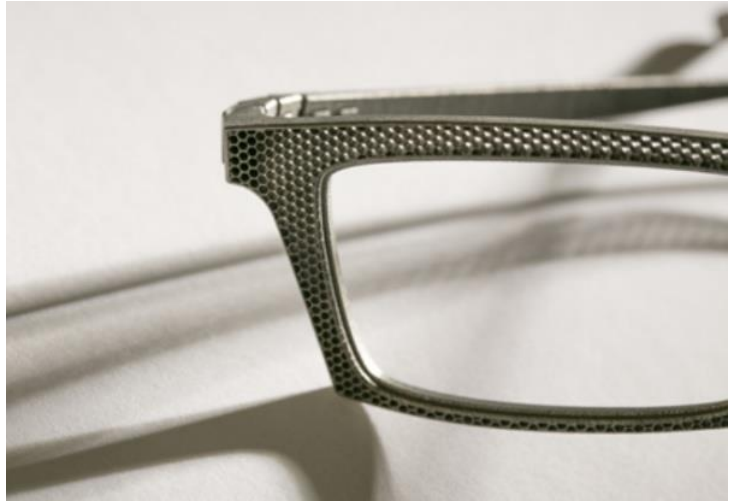
3D打印技術：粉末型

Selective Laser Sintering (SLS)
(選擇性鐳射燒結技術)



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CERAMIC 3D PRINTING (陶瓷3D列印)

ADMATEC
Additive Manufacturing Technologies

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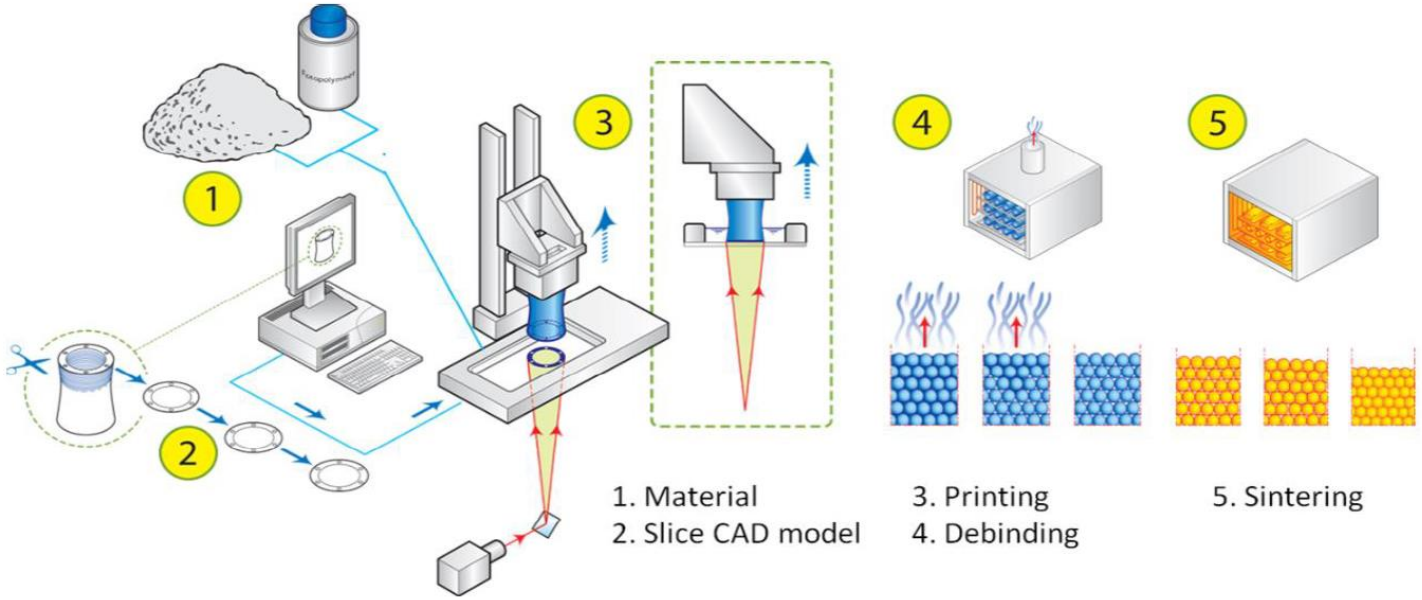
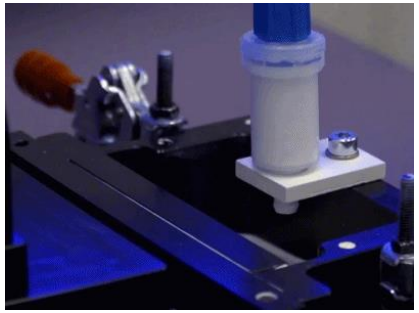
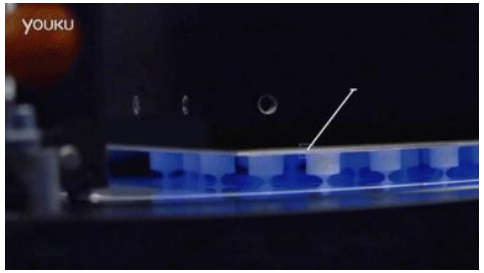
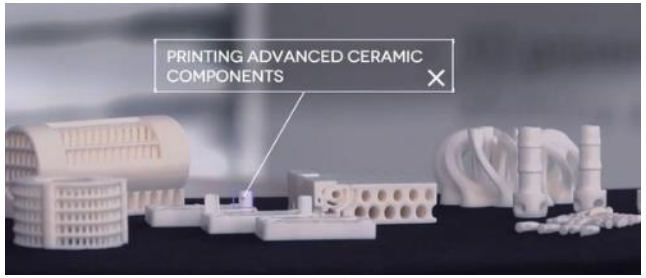
陶瓷3D列印 - 過程及原理









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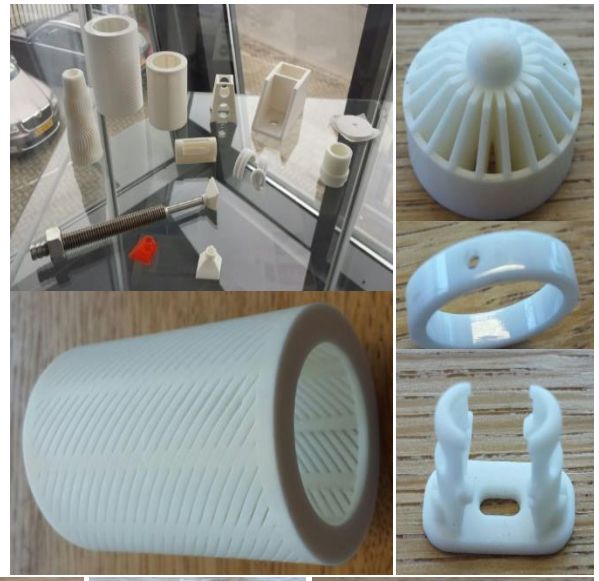
陶瓷3D打印應用行業



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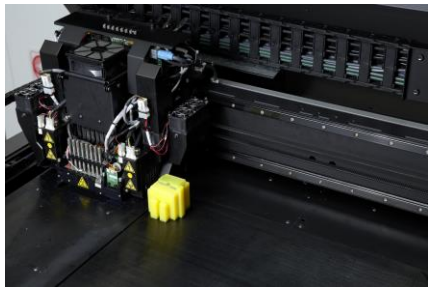
工業級3D打印機例子

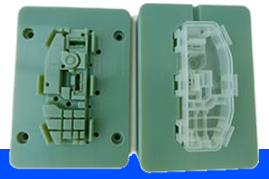
PolyJet 3D Printer

- 光聚合型（光敏聚合物噴射(PolyJet)）
- 全彩色 (多達 360,000種顏色)
- 多物料打印
- 如：橡膠質感、堅固物料；透明及實色材料
- 精細及高像素打印效果
- 最大可加工尺寸: 390mm x 490mm x 200mm
- 精確度: +/- 0.02mm



■ 應用：

- 數碼生產
- 小批量生產之模具，夾具等
- 高像真度美術模型 如：醫學模型
- 用於產品開發階段之功能性測試



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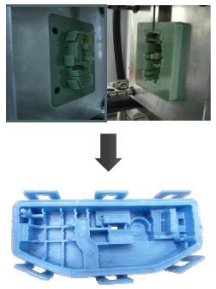
工業級3D打印機例子

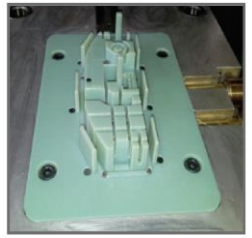
PolyJet Technology
(光敏聚合物噴射技術)

Stratasys J750 PolyJet 3D Printer

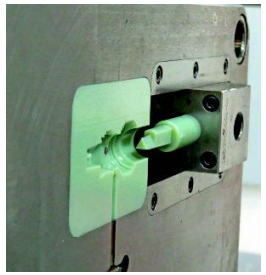
Quick Mold Application (應用PolyJet技術於快速模具製作)

- **Digital ABS material**
- Reasonable molding temperatures
  < 300 °C (570 °F) (可抵受高達300度的注塑溫度)
- Candidates: (可取代傳統金屬模具，注塑不同塑膠的產品)
  - PE, PP, PS, ABS, TPE
  - PA, POM, PC-ABS
  - Including glass-filled resins
- Quantity: 5 – 100 pcs
  (每套模具可生產5-100件注塑件，產量視乎注塑物料而定)
- Quick and cost effectively
  (大幅縮短生產時間及成本)
- Create prototypes from final production material
  (可快速製作跟量產件物料一致的產品)
- Gather true-to-life performance data
  (可預早獲取量產件資料及表現)
- Reduce / eliminate rework on final production molds
  (減少/消除最終生產模具的再加工次數及時間)

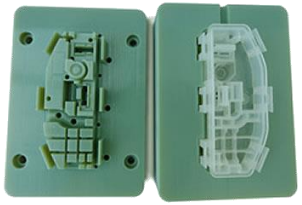




Core mold insert assembled to the mold base.



Method (In House) (加工方法)	Time (時間)	Cost (成本)
Metal Mold (傳統金屬模具)	56 Days	US$52,725 (HK$411,255)
PolyJet Mold (光敏聚合物噴射技術模具)	2 Days	US$1,318 (HK$10,280)
Savings (節省)	**54 Days (96%)**	**$51,407 (99%)** (HK$400,974)



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https://youtu.be/R_CAyZKw8ok

工業級3D打印機例子

PolyJet Technology
(光敏聚合物噴射技術)

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工業級3D打印機例子

PolyJet Technology
(光敏聚合物噴射技術)

應用PolyJet技術製作眼鏡

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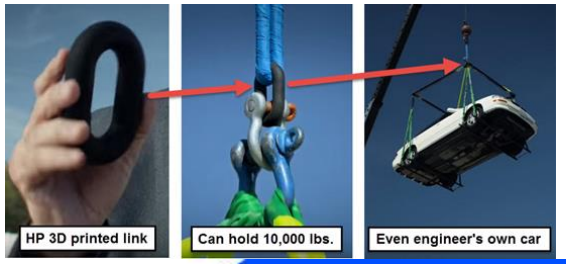
工業級3D打印機例子

Jet Fusion 3D Printer：

- 粉末型（光射流熔融3D打印）
- 快速直接量產制造
- 製作速度提升１０倍
- 與傳統3D打印比較，成本更低
- 性能更強，強度媲美傳統注塑
- Material: PA 12 (尼龍 12)
- 最大可加工尺寸: 380mm x 284mm x 380mm
- 精確度: +/-0.2mm

應用：

- 堅韌耐用、專業產品
- 高強度零部件
- 複雜結構、外殼、連接器



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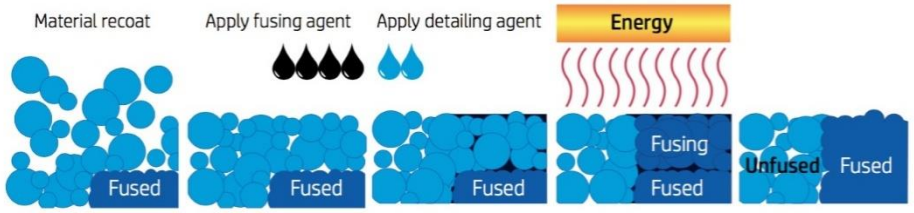
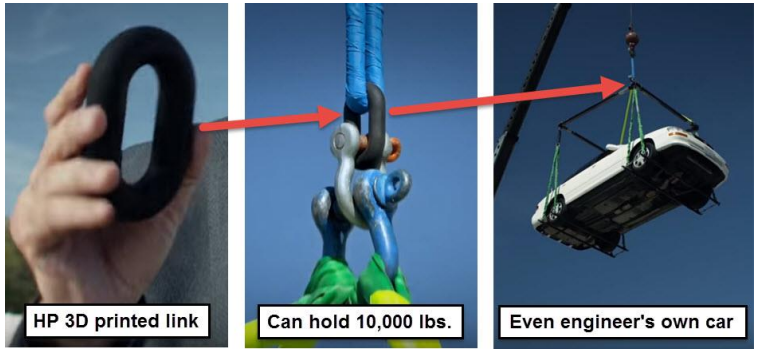
Jet Fusion 3D 打印與直接製造技術





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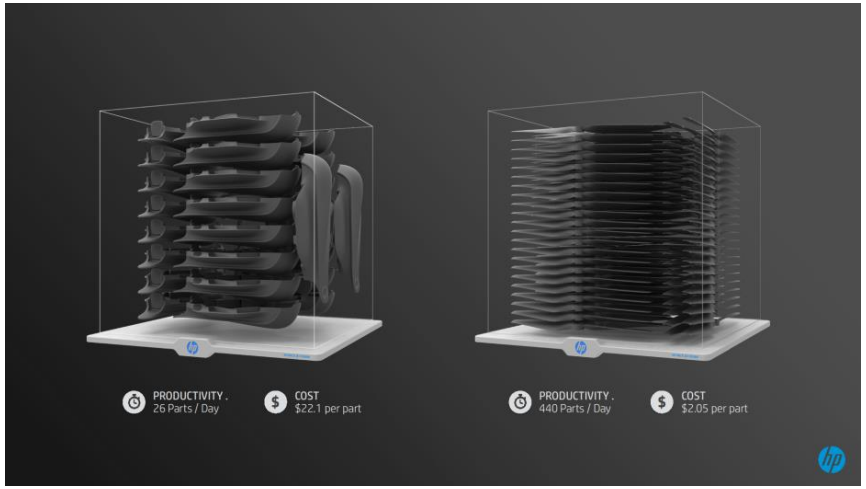
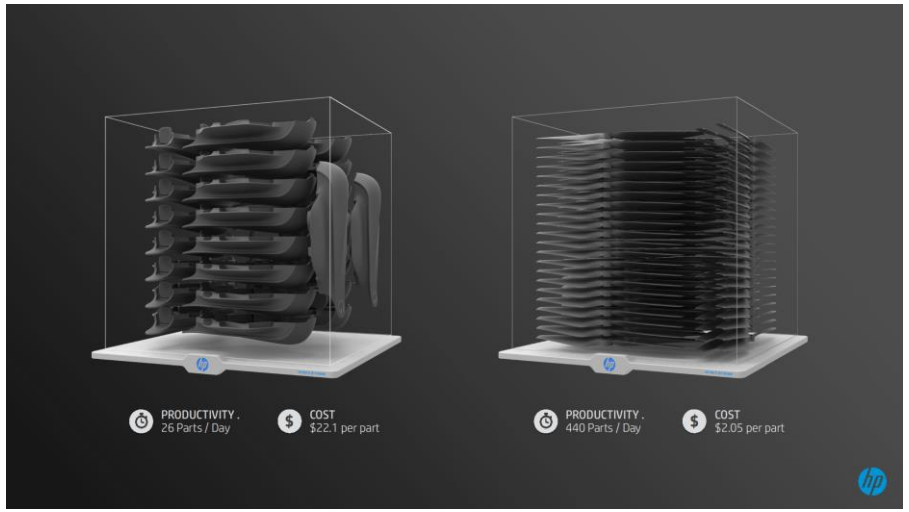
Jet Fusion 3D 打印與直接製造技術





PRODUCTIVITY
588 Parts / Day

COST
HK$25 per part

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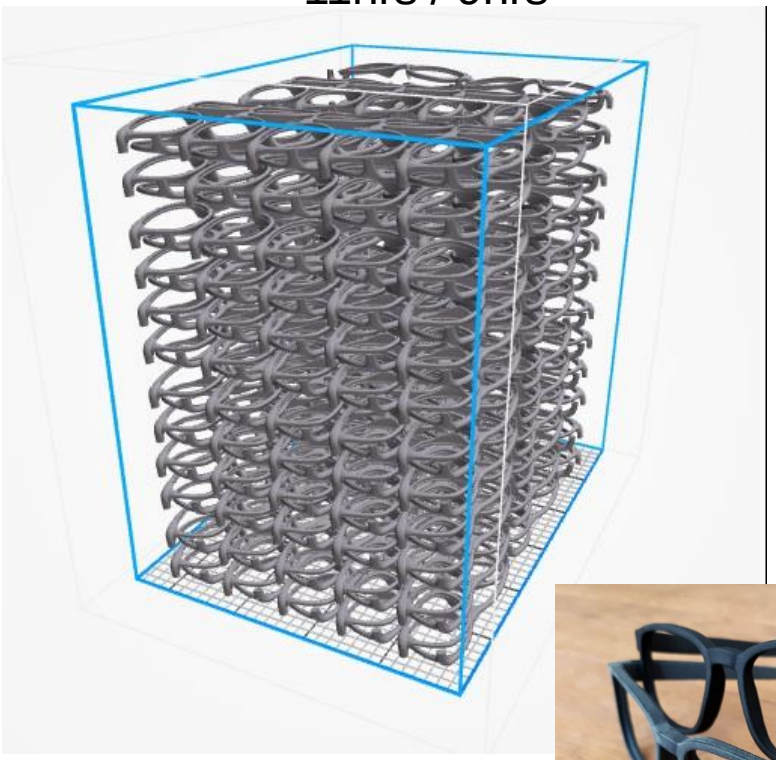
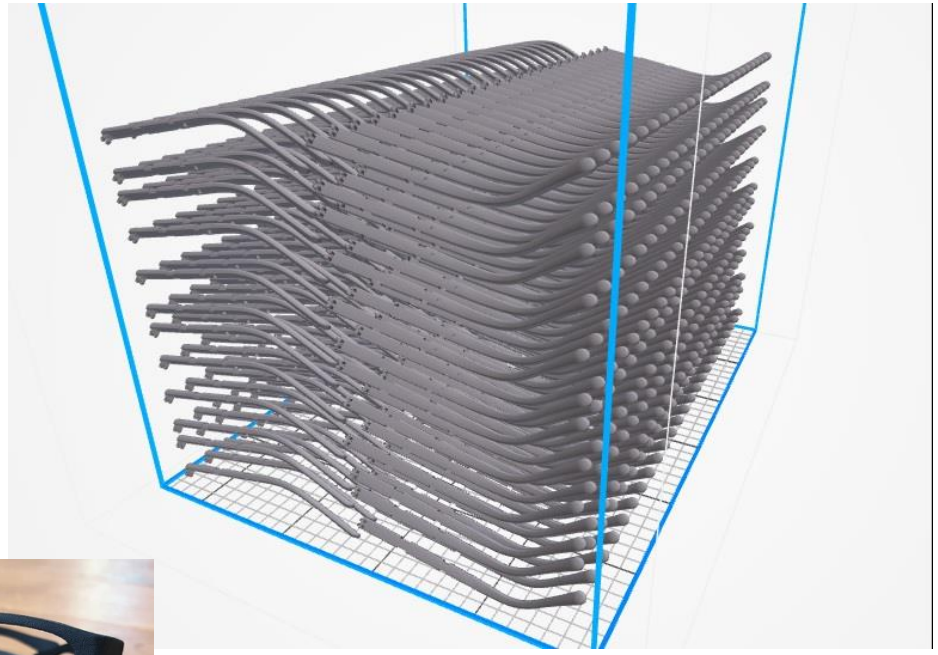
實際應用

PRODUCTIVITY
288Sets / Tank
11hrs / 9hrs

COST
HK$40 per unit

WEIGHT
11g





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實際應用案例

※「BAPE XXV project」相關單品已於2018年5月26日起陸續開賣，限量款眼鏡預計於2018年9月底於全球上市！

全球限量200副！「BAPE XXV」25週年限定眼鏡

EYEWEAR

NEW SOLD OUT

BAPE XXV CITIES CAMO SUNGLASSES MENS BLACK

$465.00

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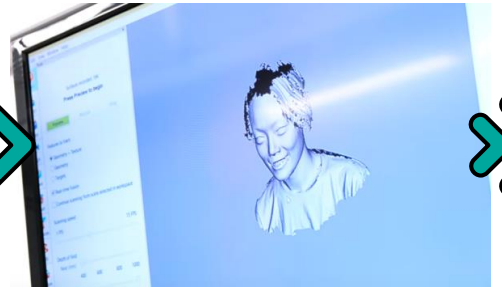
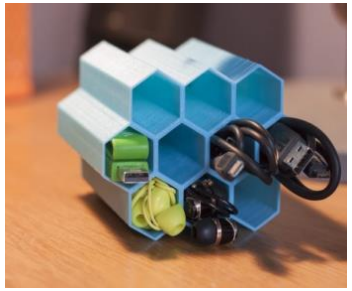
3D打印應用：日常領域

3D打印服務實際應用，小至日常生活用品，大至醫療、航天科技的發展。

廣告設計



生活用品



食品設計

時裝設計

還有…

- 家居電器
- 汽車零部件

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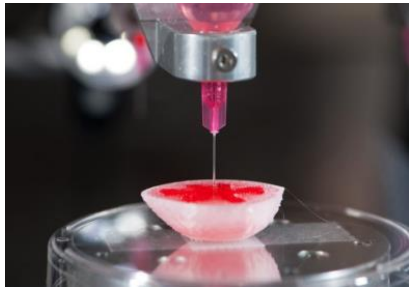
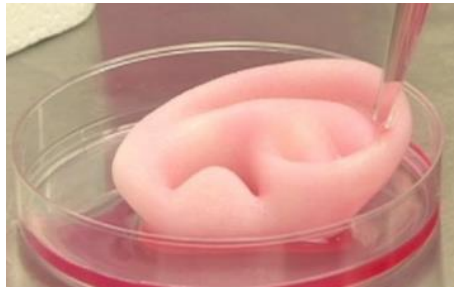
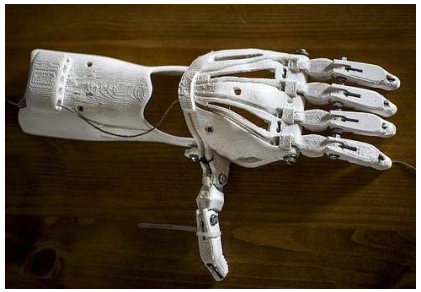
3D打印應用：醫療領域

3D打印服務實際應用，小至日常生活用品，大至醫療、航天科技的發展。

人體器官

復康治療



關節更換

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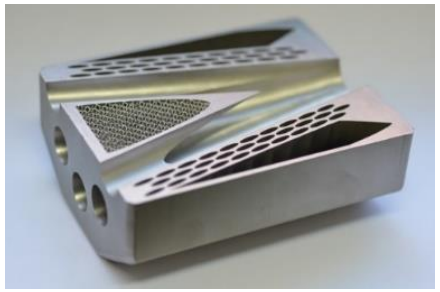
3D打印應用：工業領域

3D打印服務實際應用，小至日常生活用品，大至醫療、航天科技的發展。

航空零件

模具水路



金屬零件

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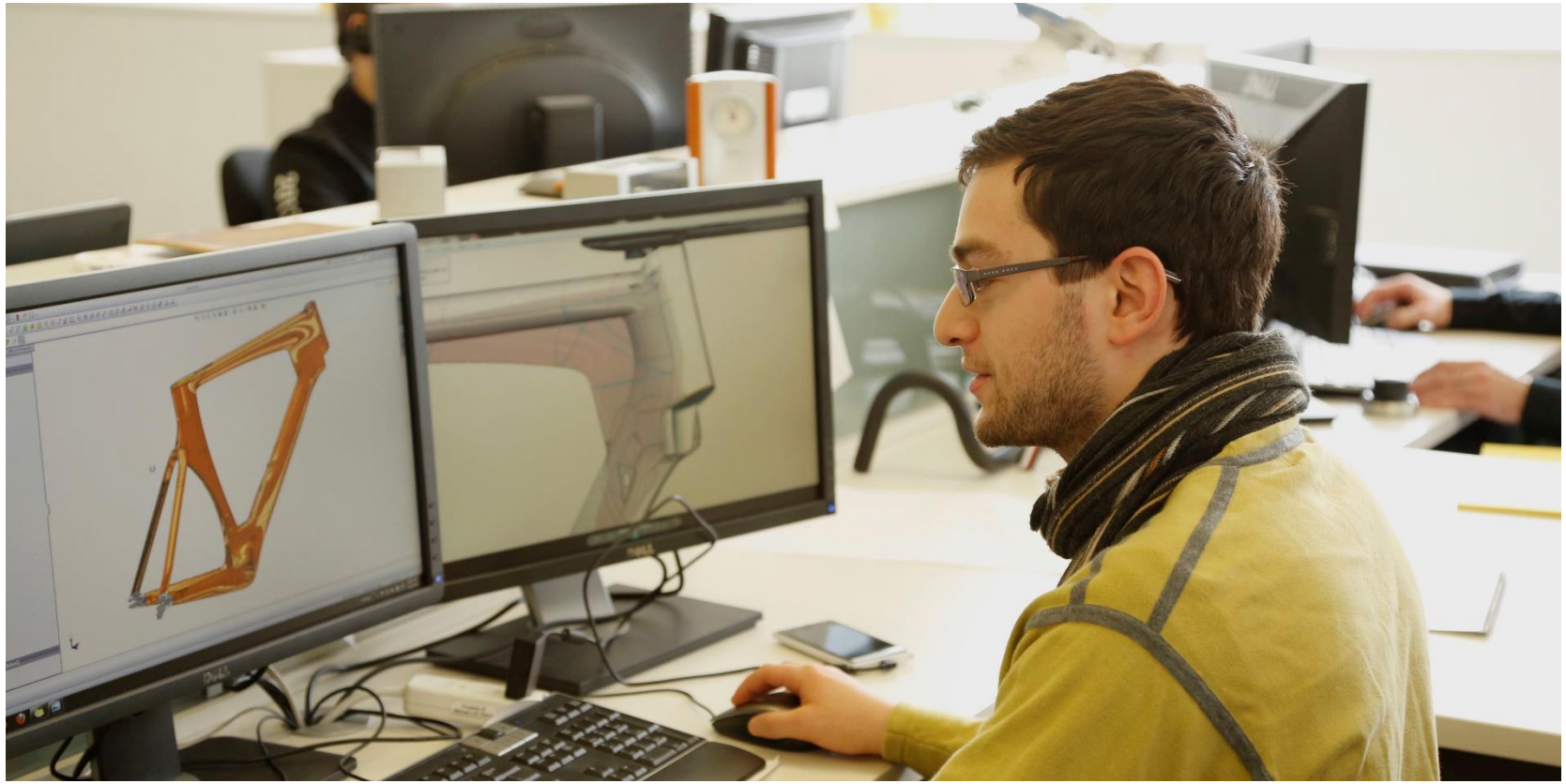
虛擬數據模型：電腦輔助繪圖(CAD)

Digital model: CAD it yourself



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虛擬數據模型：三維(3D)素描

Digital model: 3D scan it

Source : Makerbot

Source : Artec

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一般3D建模軟件

SOLIDWORKS

Rhinoceros

360

SketchUp

blender

TINKERCAD

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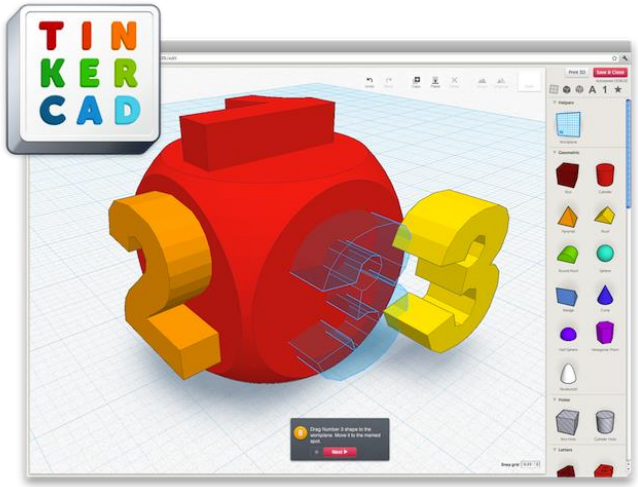
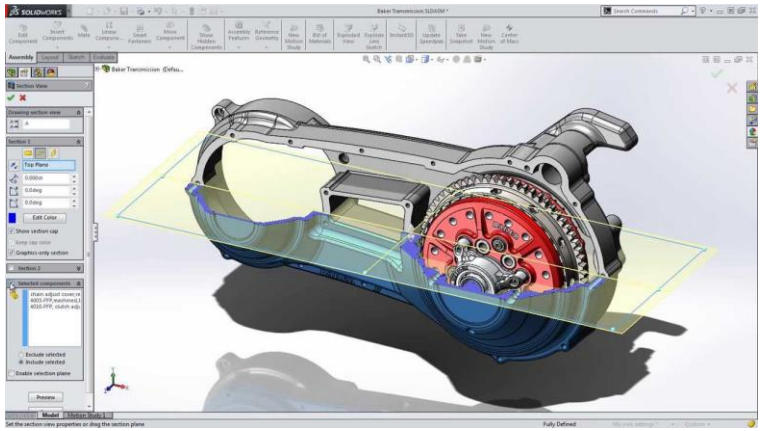
電腦輔助繪圖(CAD)軟件

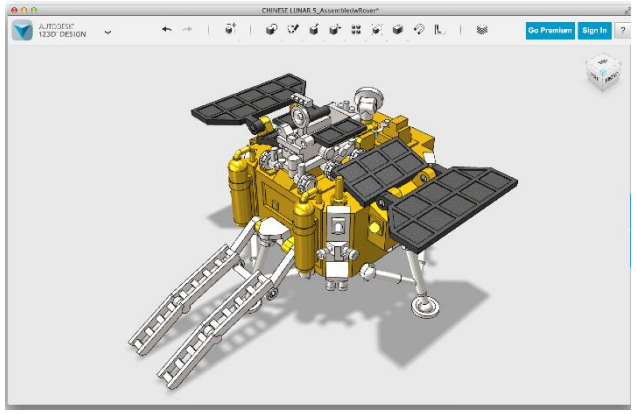
CAD Software Options

- **Tinkercad**
  Free, Web-based
- **Blender**
  Free
- **OpenScad**
  Free, Programming based
- **Solidworks, UG NX, Pro-E**

  Professional grade design software







- 無論使用哪種3D建模軟體，生成的3D模型（通常為.stp .step .3ds或其它格式）都需要轉換成.STL或.OBJ這類印表機可以讀取的格式。

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參觀先進3D打印與直接製造中心

Thank you

Hong Kong Productivity Council
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香港九龍達之路78號生產力大樓
Tel: +852 2788 5678 Whatsapp: +852 5283 4131
www.hkpc.org

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眼鏡設計中的
設計思維過程

Design Thinking Process in
Eyewear Design

傳統製造

到3D打印生產的模式轉變

Paradigm shift

from traditional manufacturing to 3D printing production

VS

傳統製造

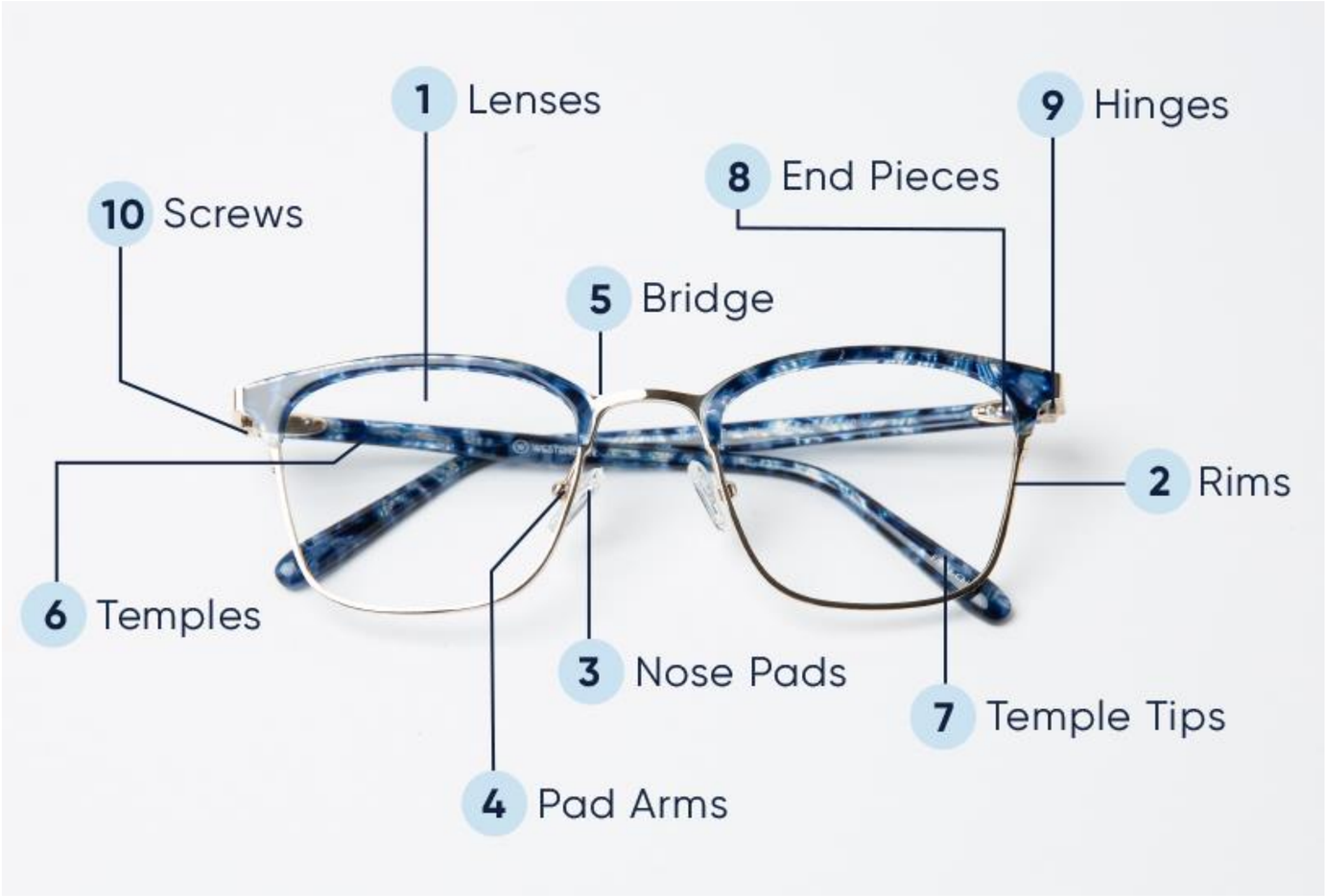
3D打印

傳統製造

3D打印

產品

傳統製造


1 Lenses
9 Hinges
8 End Pieces
10 Screws
5 Bridge
2 Rims
6 Temples
3 Nose Pads
7 Temple Tips
4 Pad Arms

傳統製造

傳統製造

產品為中心

指定款式
Specify Style
流水線
Assembly Line
[單一設計]
Single Design
產品
[批量生產]
Mass Production
原材料採購
Material Sourcing

一體成型

3D打印

3D打印

用戶為中心

不同款式
Different Style
需求
Demand
[多樣化設計]
Diversified Design
用戶
[單件生產]
Single-piece Production
個性化訂製
Personalisation

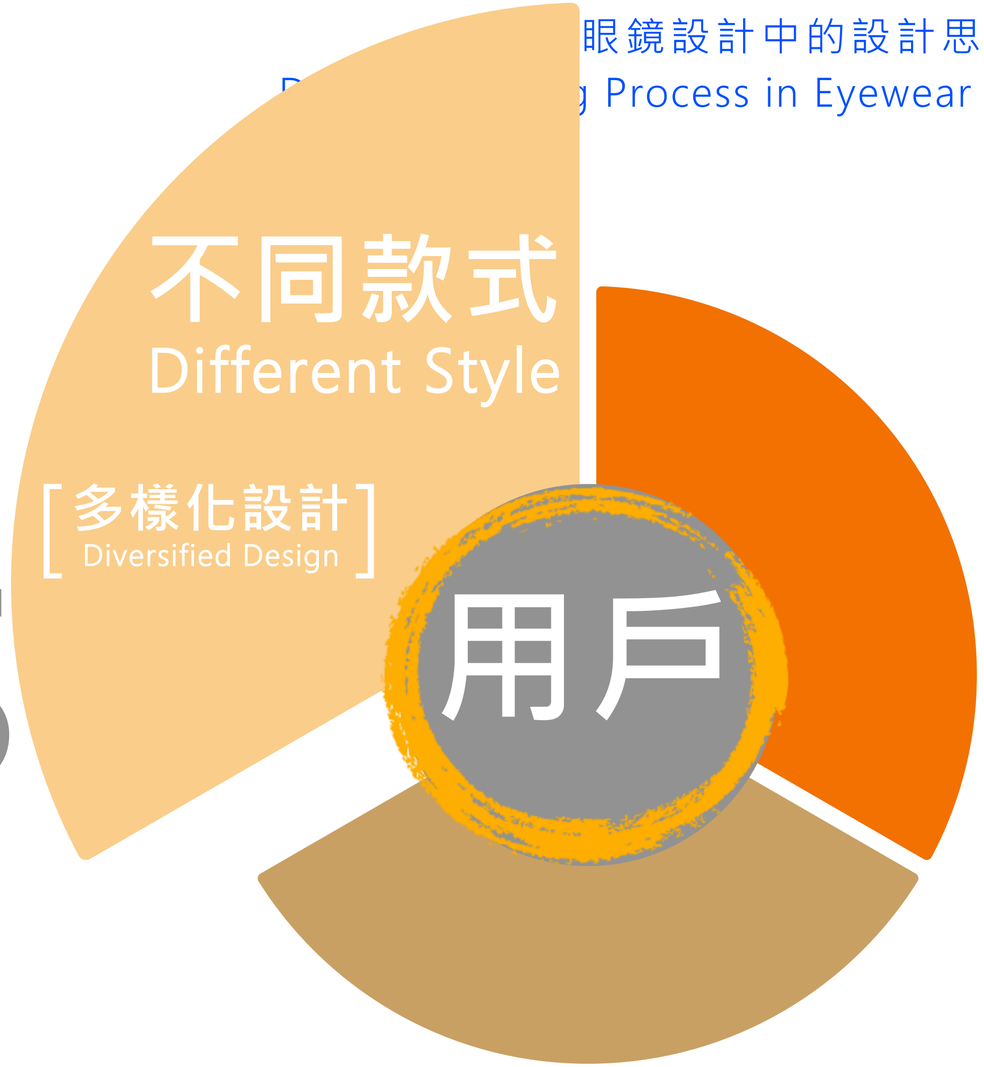
VS

傳統製造

3D打印

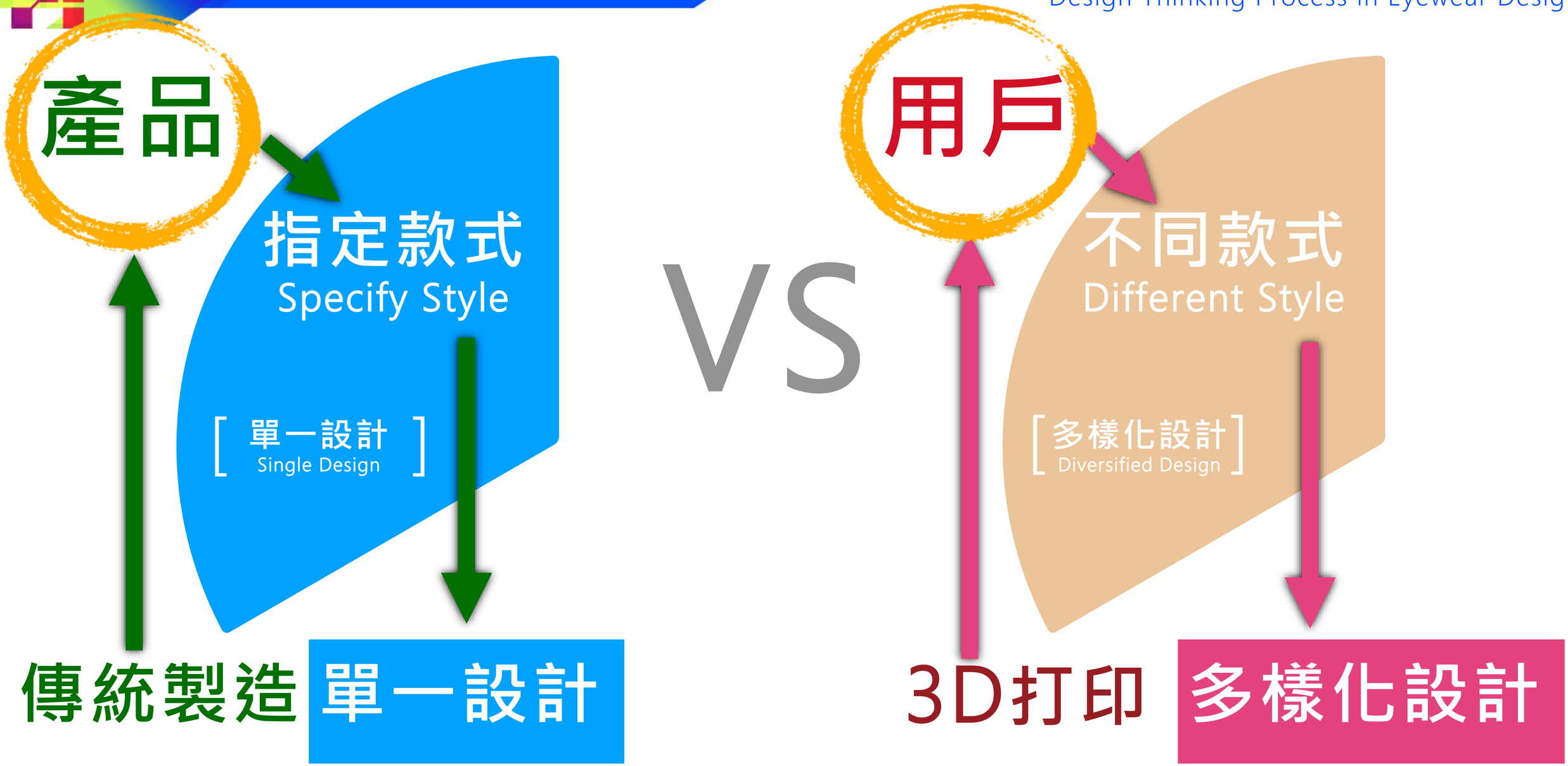
指定款式
Specify Style
[單一設計]
Single Design
產品

VS


不同款式
Different Style
[多樣化設計]
Diversified Design
用戶

傳統製造

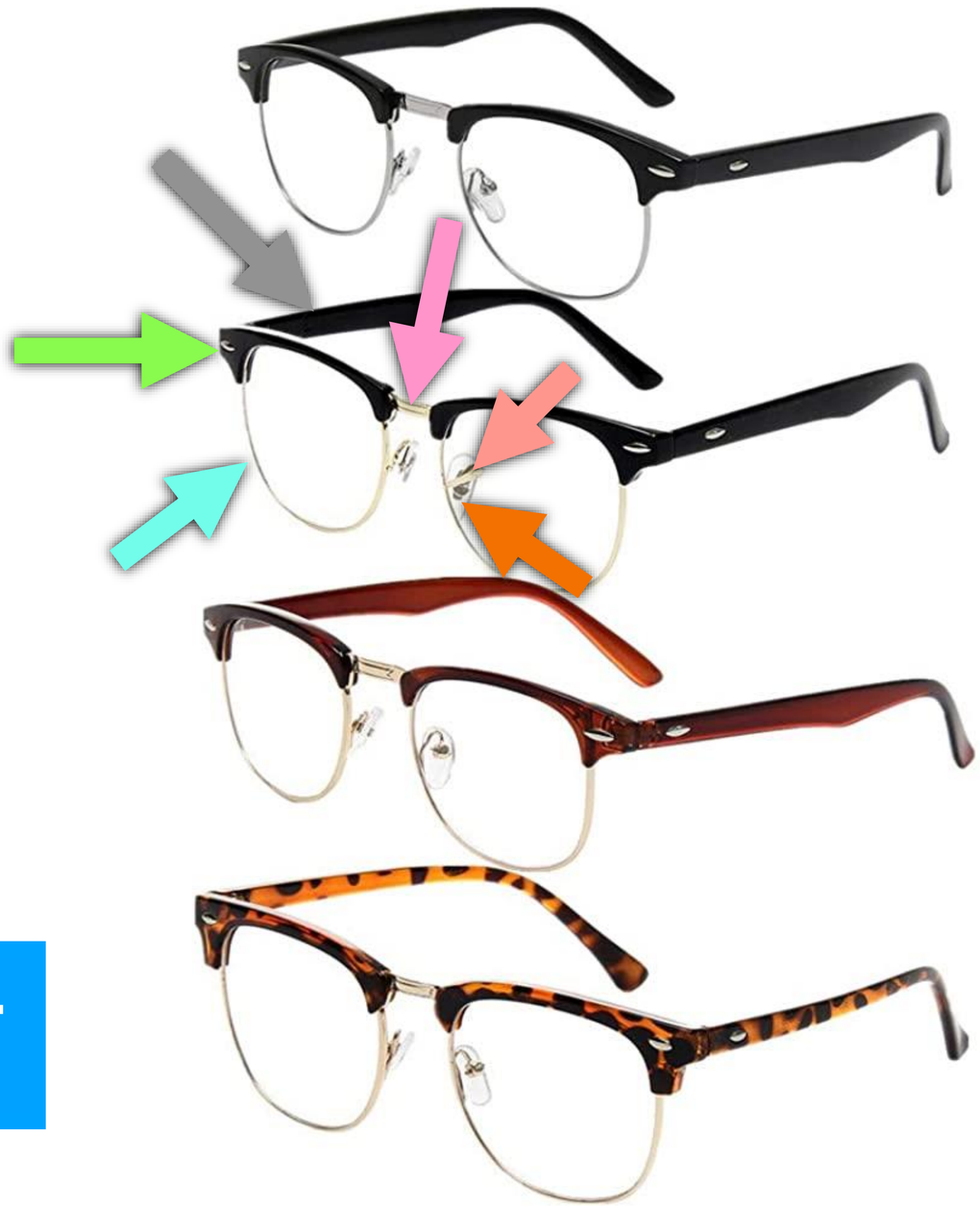
3D打印


產品
指定款式
Specify Style
[單一設計]
Single Design
傳統製造
單一設計
VS
用戶
不同款式
Different Style
[多樣化設計]
Diversified Design
3D打印
多樣化設計

產品

指定款式
Specify Style

[單一設計
Single Design]



傳統製造 單一設計

用戶

不同款式
Different Style

[多樣化設計
Diversified Design]

3D打印 多樣化設計

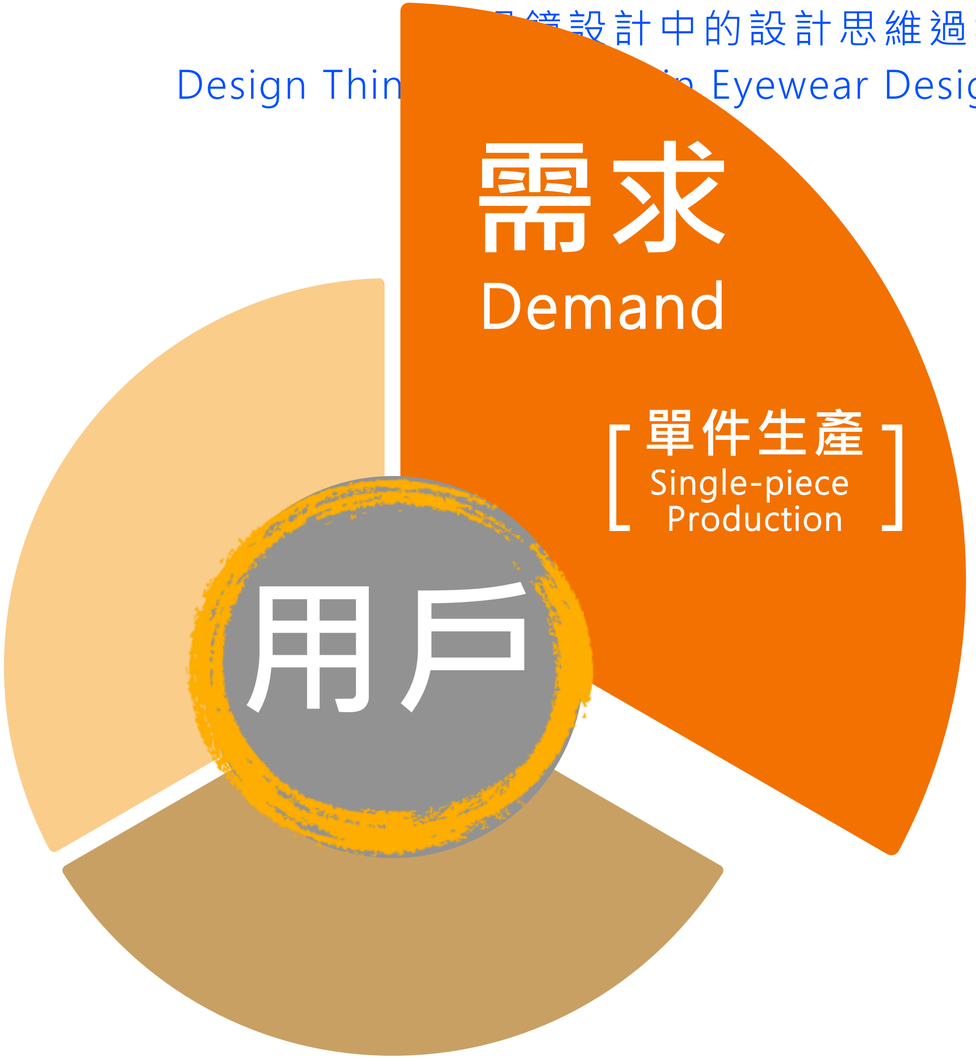
VS

傳統製造

3D打印

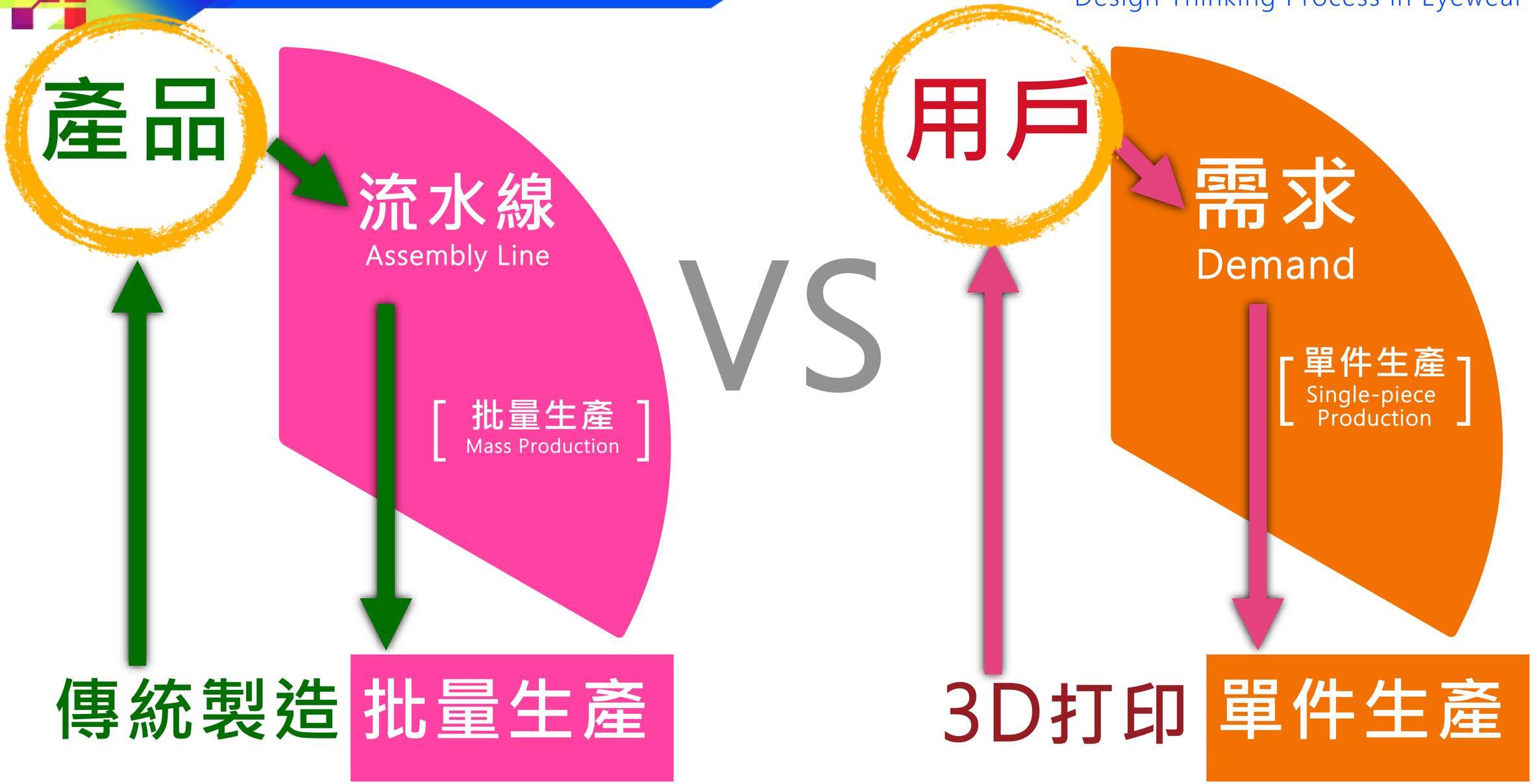
流水線
Assembly Line
[批量生產
Mass Production]
產品

VS


需求
Demand
[單件生產
Single-piece
Production]
用戶

傳統製造

3D打印


產品
流水線
Assembly Line
[批量生產 Mass Production]
VS
用戶
需求
Demand
[單件生產 Single-piece Production]
傳統製造
批量生產
3D打印
單件生產

產品

流水線
Assembly Line

[批量生產
Mass Production]

傳統製造 批量生產

用戶

需求
Demand

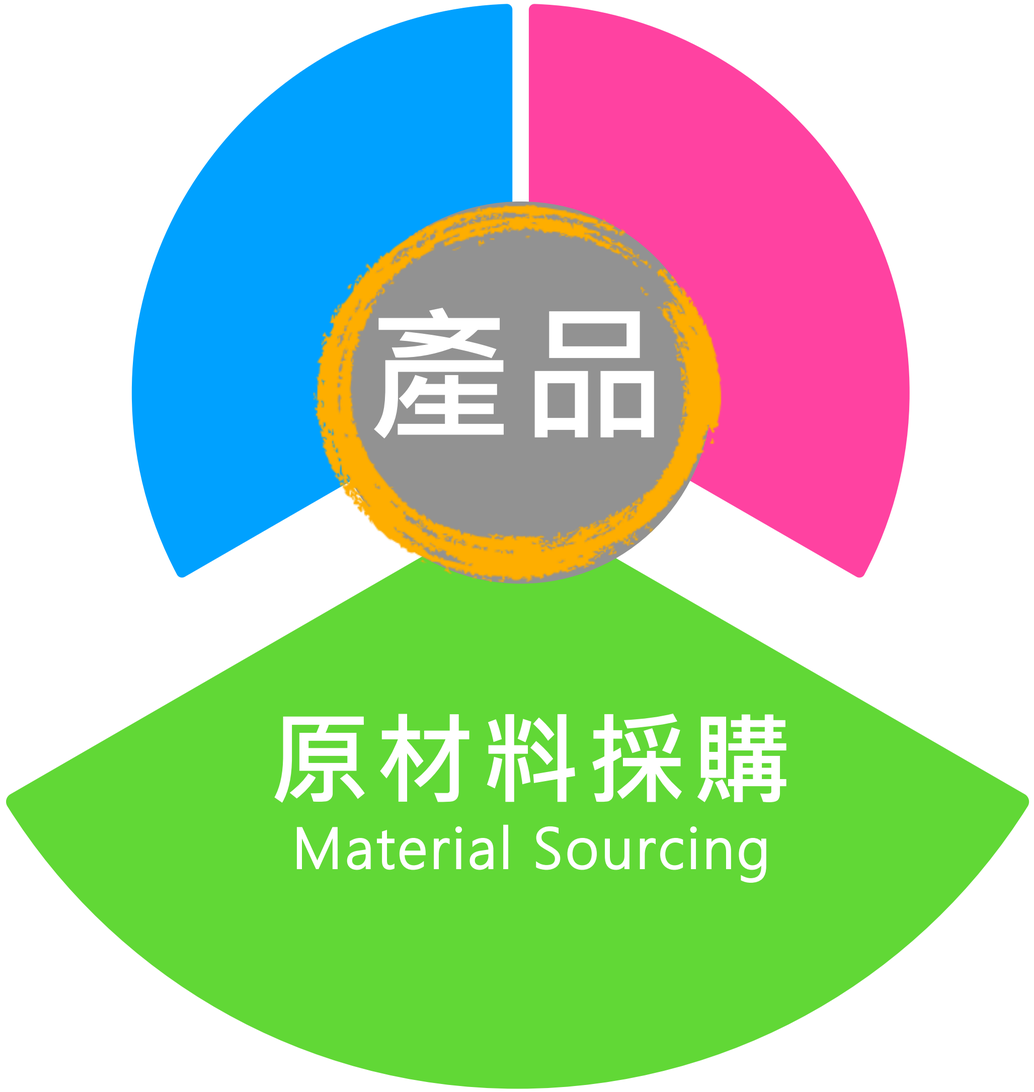
[單件生產
Single-piece
Production]

3D打印 單件生產

VS

傳統製造

3D打印



VS

產品

用戶

VS

原材料採購
Material Sourcing

個性化訂製
Personalisation

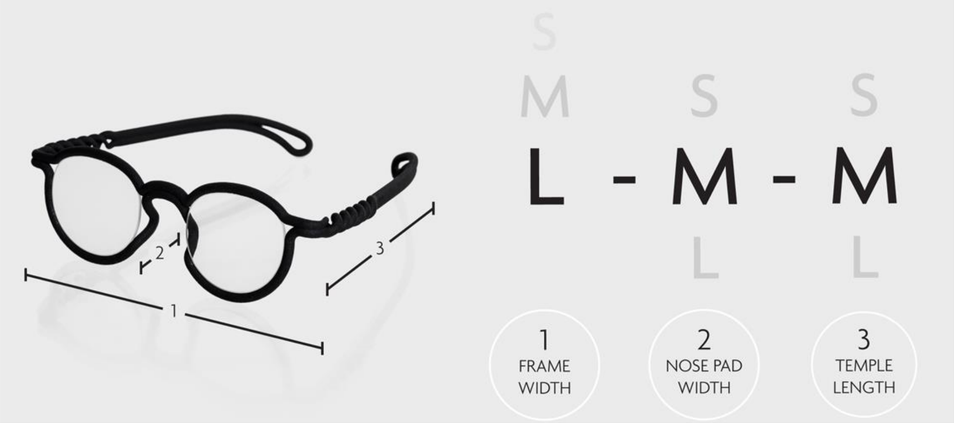
傳統製造

3D打印

產品

原材料採購
Material Sourcing

傳統製造 → 多種原材料採購
Multi Material Sourcing



用戶

尺寸訂製
Size Customisation

個性化訂製
Personalisation

單一原材料
Single Material

3D打印

設計思維

在調適線條、形狀和形態製作方向的重要性

The significance of

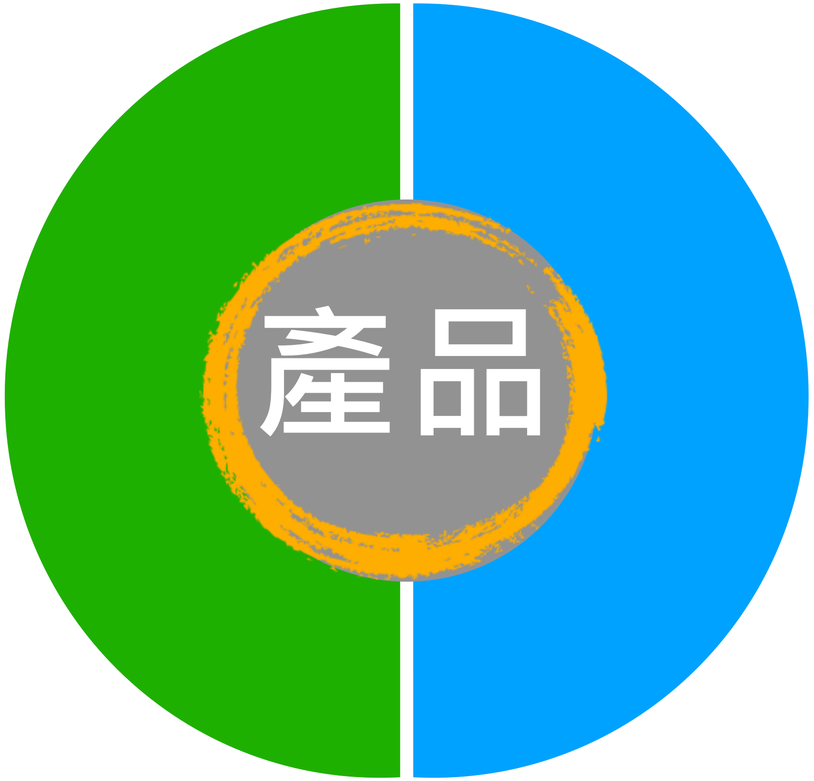
design thinking in adapting the production approach of line, shape and form

1 Lenses
9 Hinges
8 End Pieces
10 Screws
5 Bridge
2 Rims
6 Temples
3 Nose Pads
7 Temple Tips
4 Pad Arms

VS

傳統製造

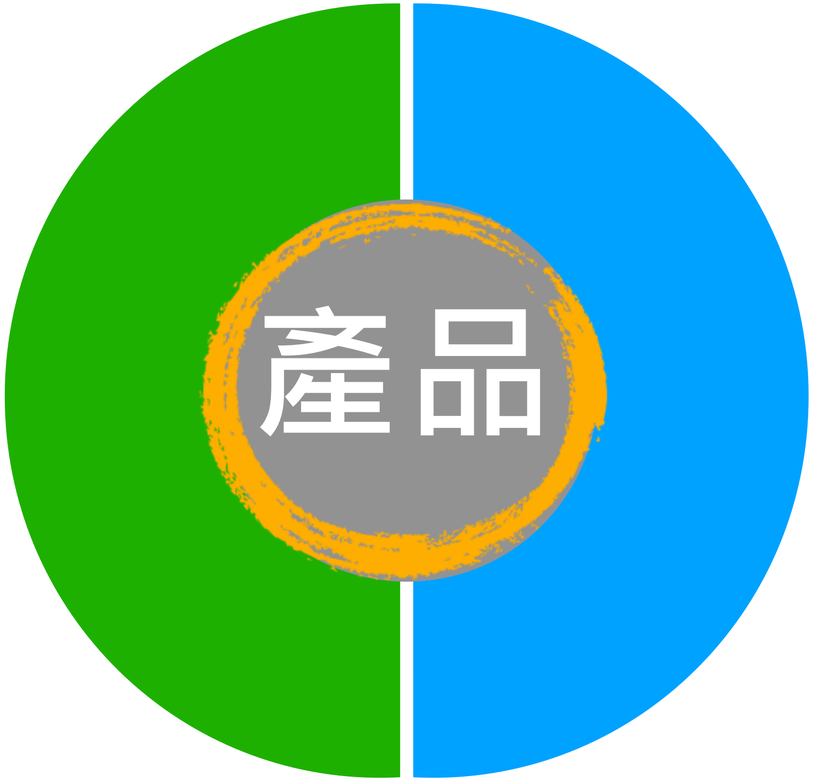
3D打印



VS

傳統製造

3D打印



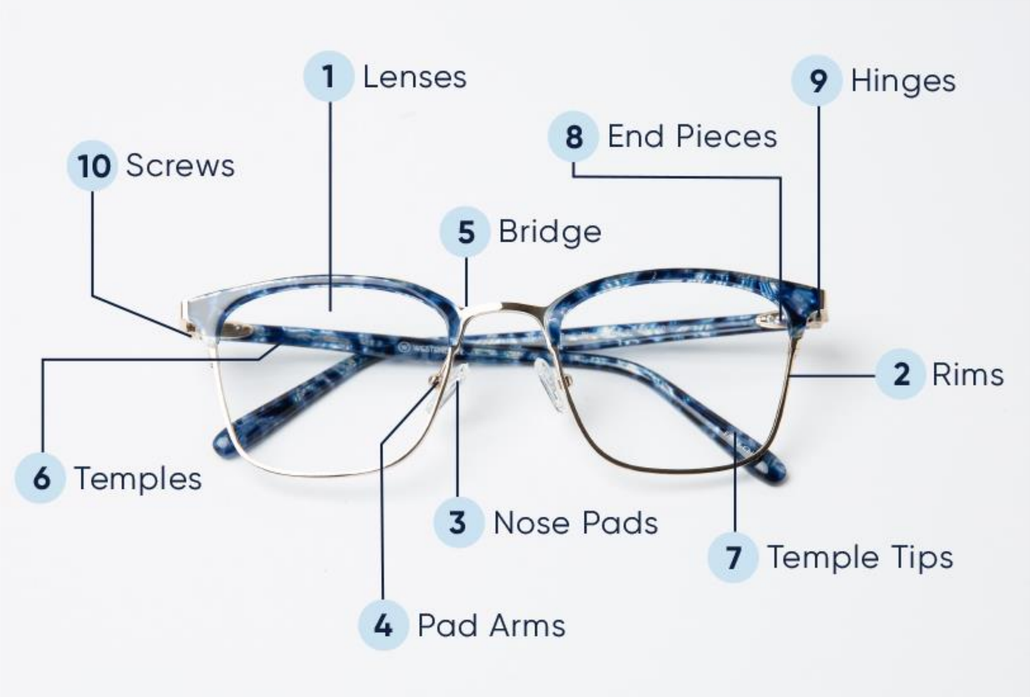
傳統製造

以傳統生產為中心：

生產效率
Productivity

+

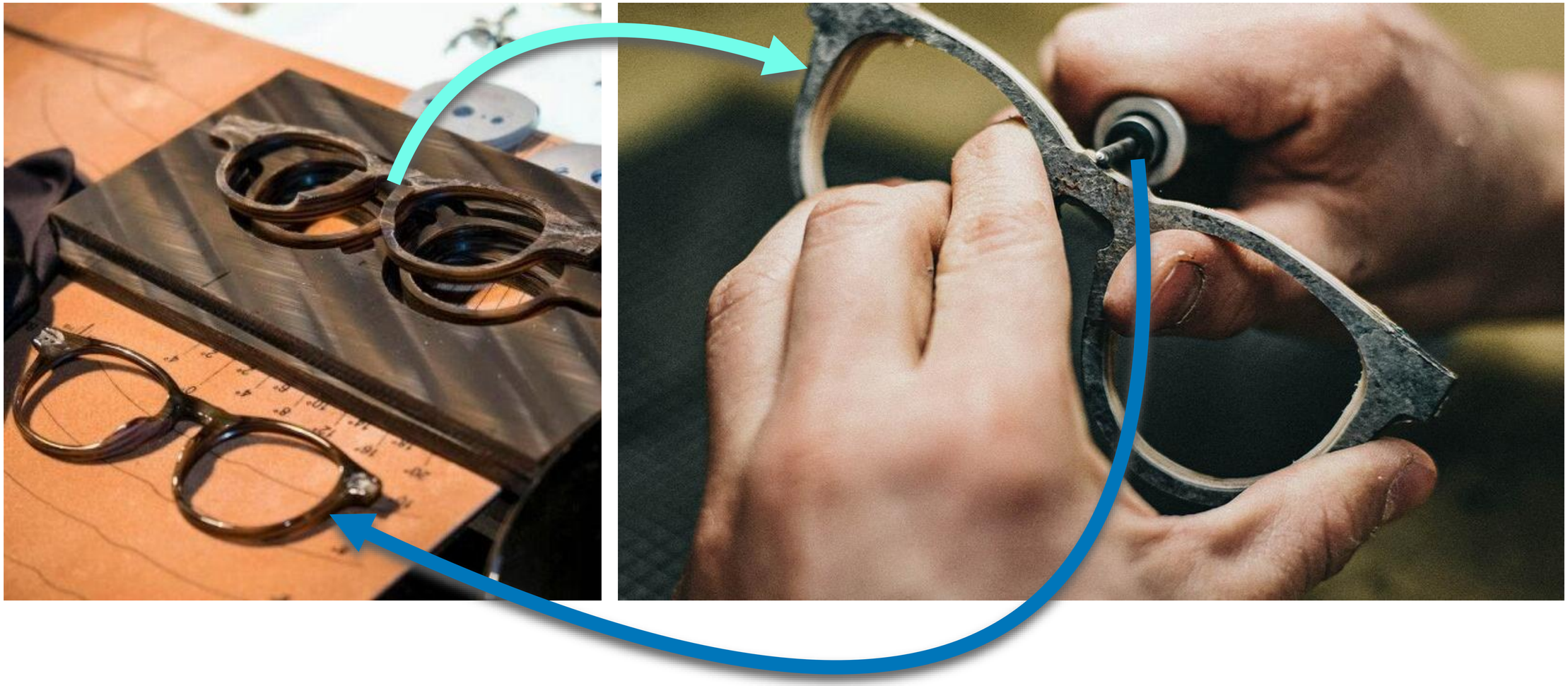
成本控制
Cost Control



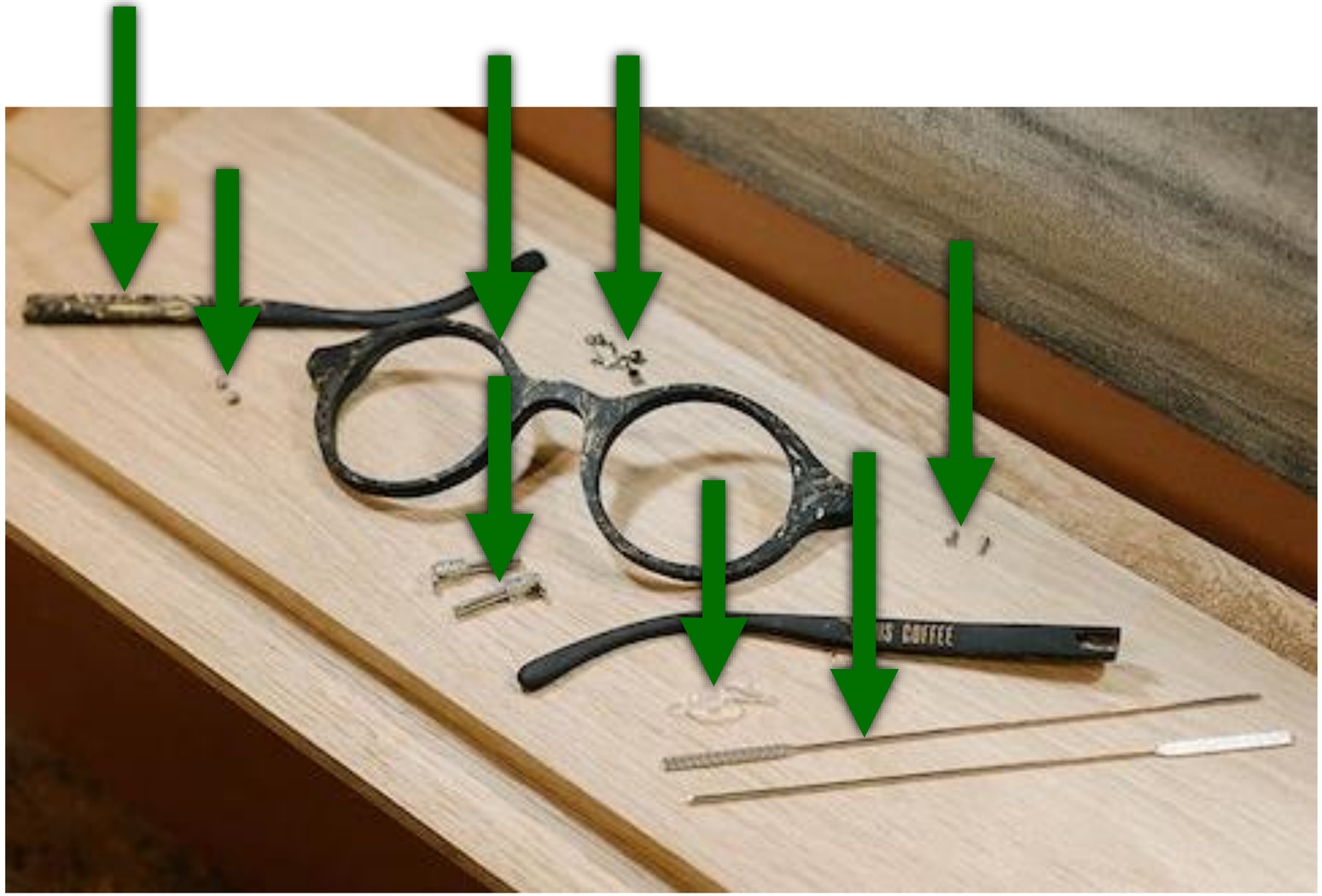
以傳統生產為中心：

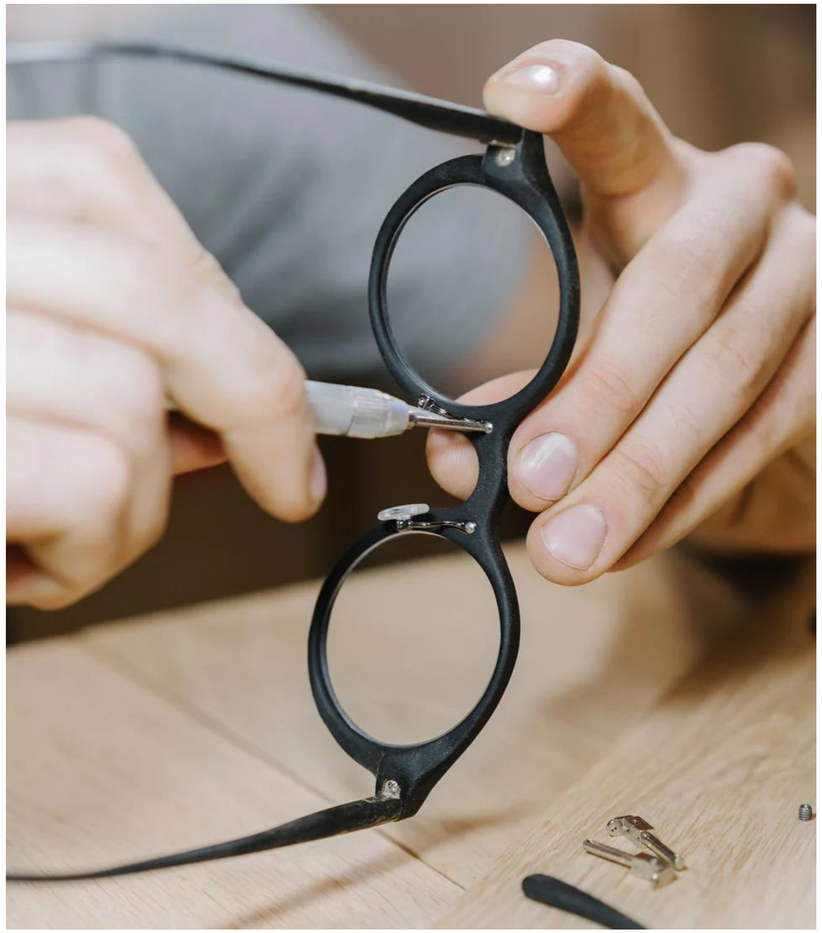
生產效率
Productivity
+
成本控制
Cost Control

眼鏡設計中的設計思維過程
Design Thinking Process in Eyewear Design



Created by Sherona Chan@ACE





以用戶為中心：

用戶需求
Demand

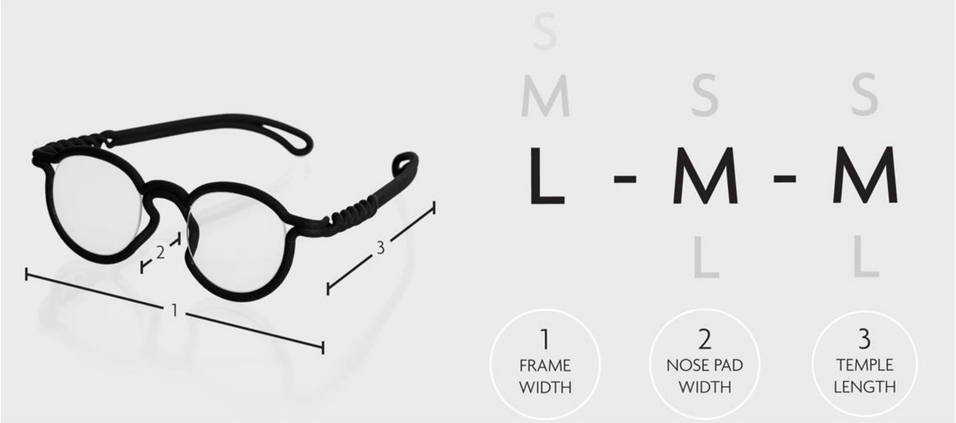
+

用戶痛點
Pain Point

3D打印

以用戶為中心：

用戶需求
Demand
+
用戶痛點
Pain Point

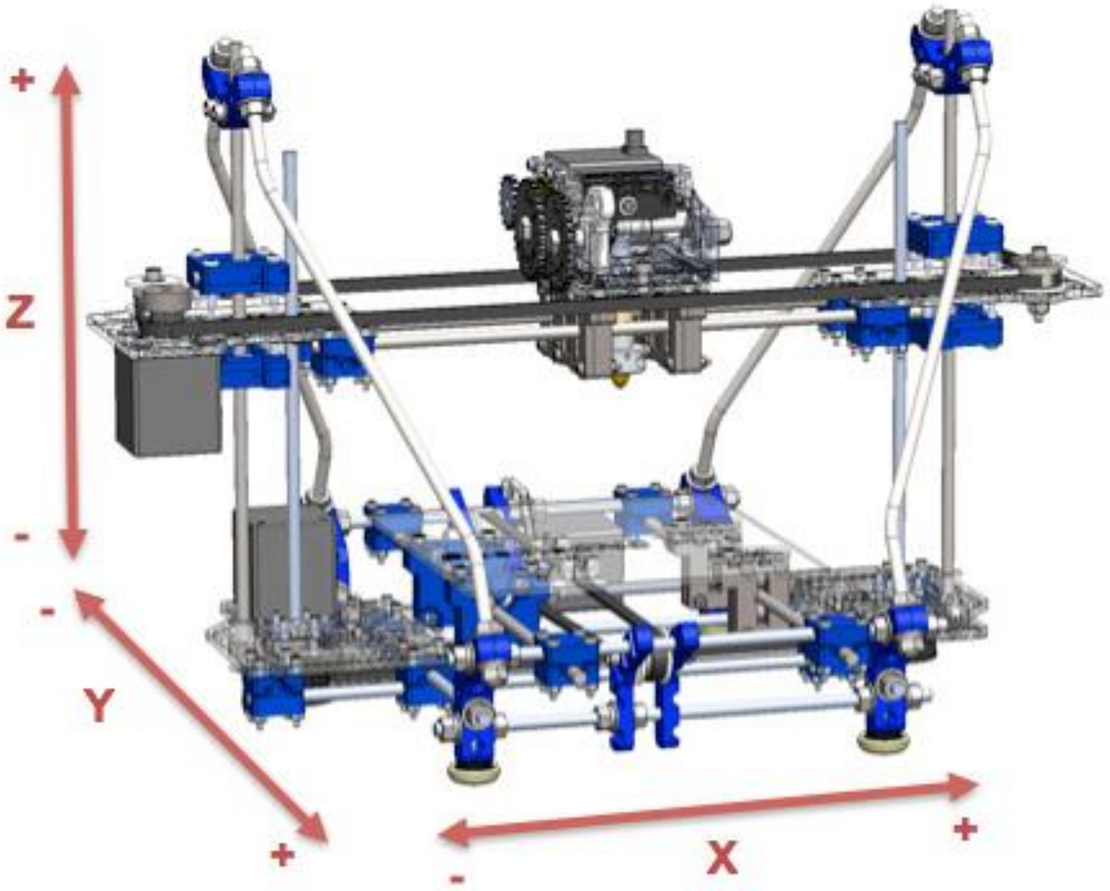


以用戶為中心：

3D打印

生產技術：

一體成型



線條、形狀和形態

創新和實驗：體驗 + 創新 + 實驗

使外觀、功能、品質都達到最佳效果

線條、形狀和形態

體驗：

功能更符合人體工學

線條、形狀和形態

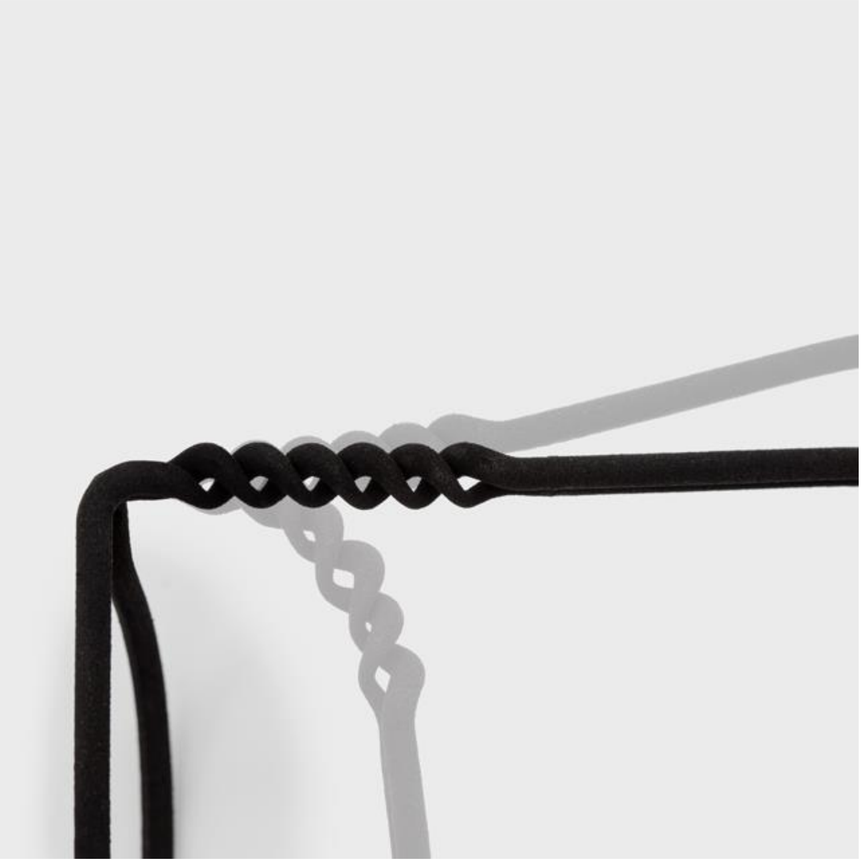
創新：

達到美觀、時尚和佩戴者的滿意度

線條、形狀和形態

創新 + 實驗：

調整製作/結構方向，
控制成品質素和耐用度



線條、形狀和形態

外觀、功能、品質

體驗

設計思維過程 - 探索個性化訂製

Experience

the Design Thinking Process - Exploration of Personalisation

探討

3D打印製作的眼鏡，如何突破最低訂貨量(M.O.Q.)的要求限制，以及定做尺寸和裝飾點綴，滿足個人化市場需求

Explore

how 3D printed eyewear meets the needs of the personalised market by overcoming minimum order quantity (M.O.Q.) requirements, as well as customised sizes and decorative embellishments

產品

用戶

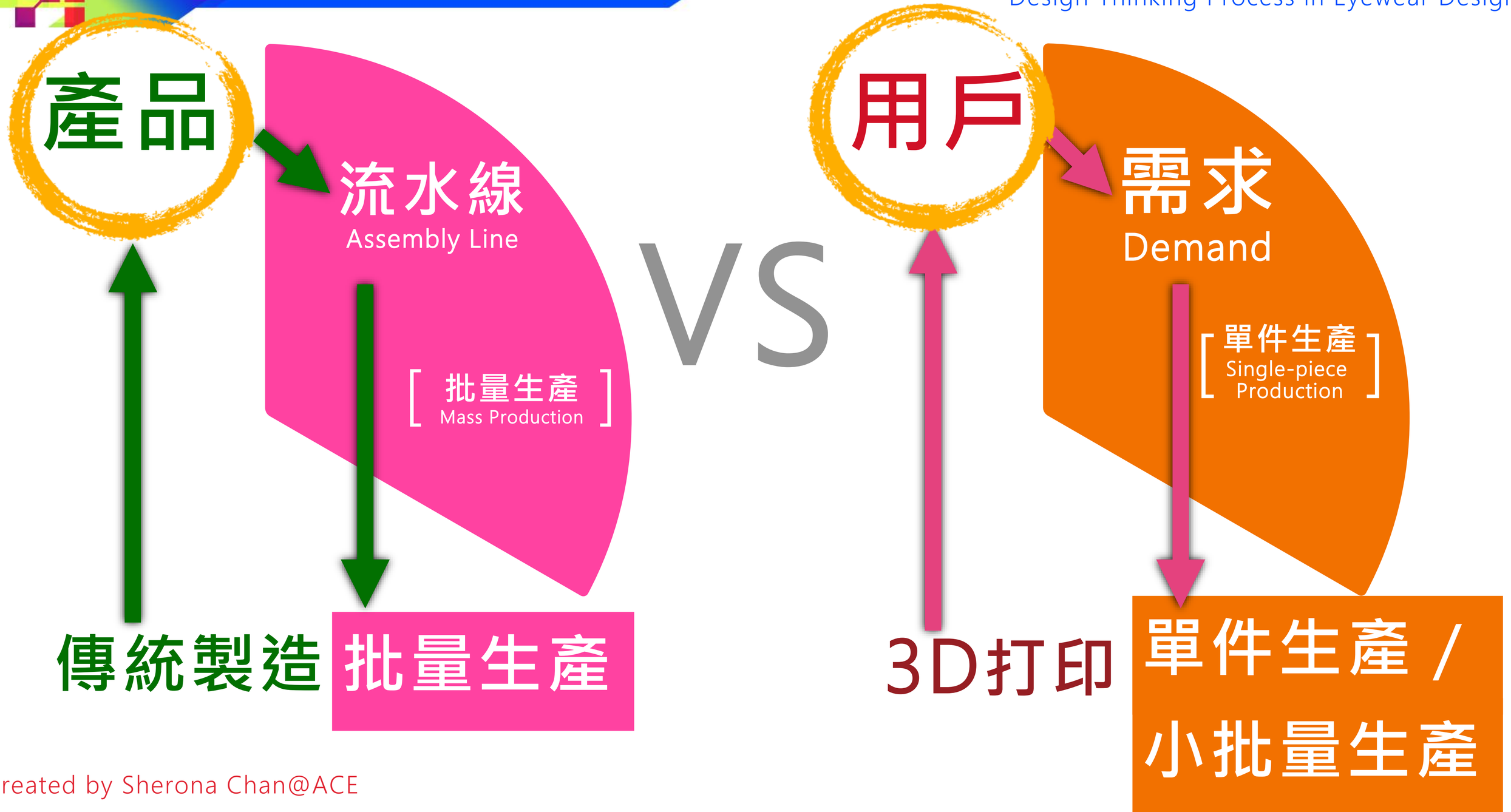
VS

原材料採購
Material Sourcing

個性化訂製
Personalisation

傳統製造

3D打印


產品
流水線
Assembly Line
[批量生產 Mass Production]
傳統製造
批量生產
VS
用戶
需求
Demand
[單件生產 Single-piece Production]
3D打印
單件生產 / 小批量生產

功能 / 裝飾

動手做練習

Hands-on practice

情境題 Situational Questions -

一位來自A市的客戶提出以下要求：
A client from City A requested the followings:

1) 設計適合所有臉型佩戴的 3D 打印眼鏡
Design 3D printed eyewear that is comfortable to wear for all facial shapes

2) 為 3D 打印眼鏡設計配件（眼鏡繩）
Design accessories (eyewear rope) for 3D printed eyewear

眼鏡設計

開發經驗分享

分享3D打印製作眼鏡的整體設計：
設計手稿、眼鏡部件的原型

Experience Sharing

of Eyewear Design Development

Overall design of 3D printed Eyewear :
Design sketches, prototypes of eyewear components

體驗

設計思維過程 - 探索個性化訂製

Experience

the Design Thinking Process - Exploration of Personalisation

解說

3D打印製作個性化眼鏡，通過提供定做製作各種尺寸組合的眼鏡，以配合不同顱骨和臉部特徵的佩戴者

Illustrates

the personalisation of 3D printed eyewear by offering a variety of made-to-measure size combinations to accommodate wearers with different cranial and facial features.

Speaker:
Mr. Edmond Wong
Architect/ Product Designer

Master of Architecture (M.Arch), BS in The Chinese University of Hong Kong

Founder: ITUM - 3D Print-to-fit everyone spectacles

Awards:

- SaloneSatellite Silver Award (2017), Salome de Mobile, Milan, Italy
- Honorable Mention (2016), Innovative Youth Housing Design Competition, Hong Kong Institute of Architects
- 40 Under 40 Award (2015), Perspective Magazine
- Hong Kong Young Design Talent Award (2015), Hong Kong Design Centre
- Gold Award (2014), Design For Asia Award, Hong Kong Design Centre
- Campion (2012), Public Art Project - Tamar Government Headquarter, LCSD, HKSARG
- Campion (2009), Harmonized Neighbourhood, Sustainable Building Design Competition, Development Council, HKSARG

MAKE SMART
SMARTER

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website: www.itum.co
Video: http://www.edmondwongstudio.com/mono-eyewear.html

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SMARTER

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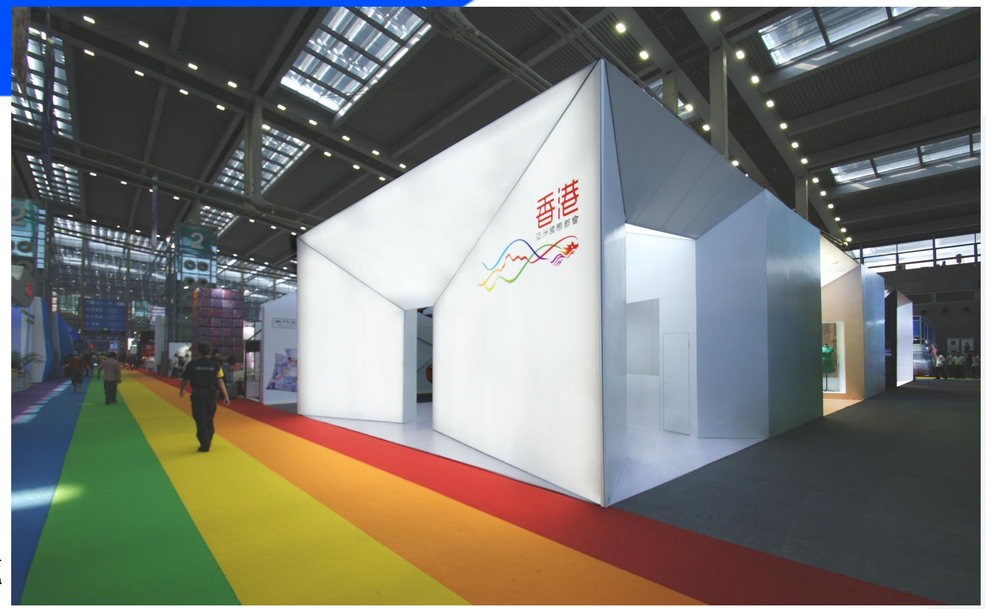
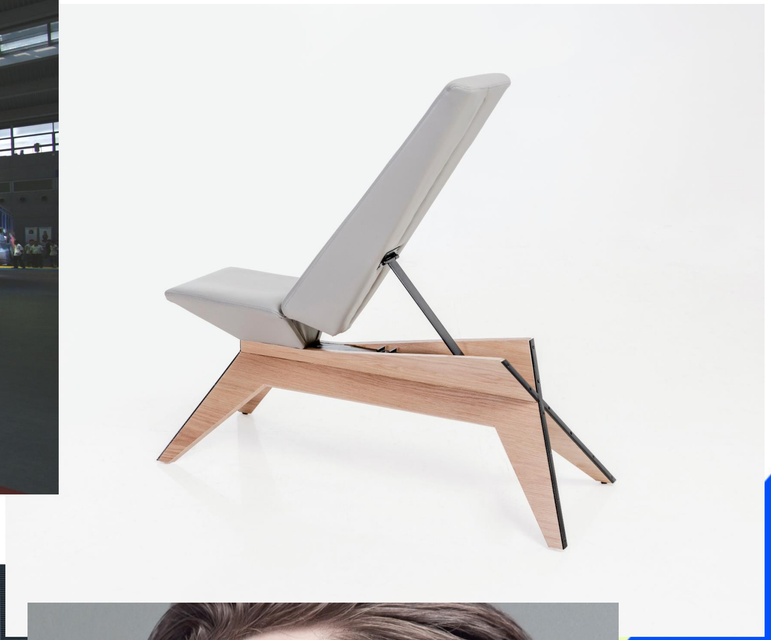
建築



展覽



傢具

室內設計

公共藝術

產品

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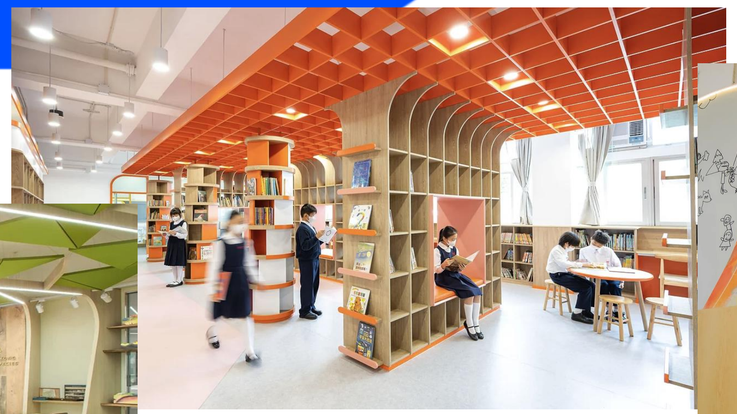
地理室



圖書館

STEM Room

英語室

接待處

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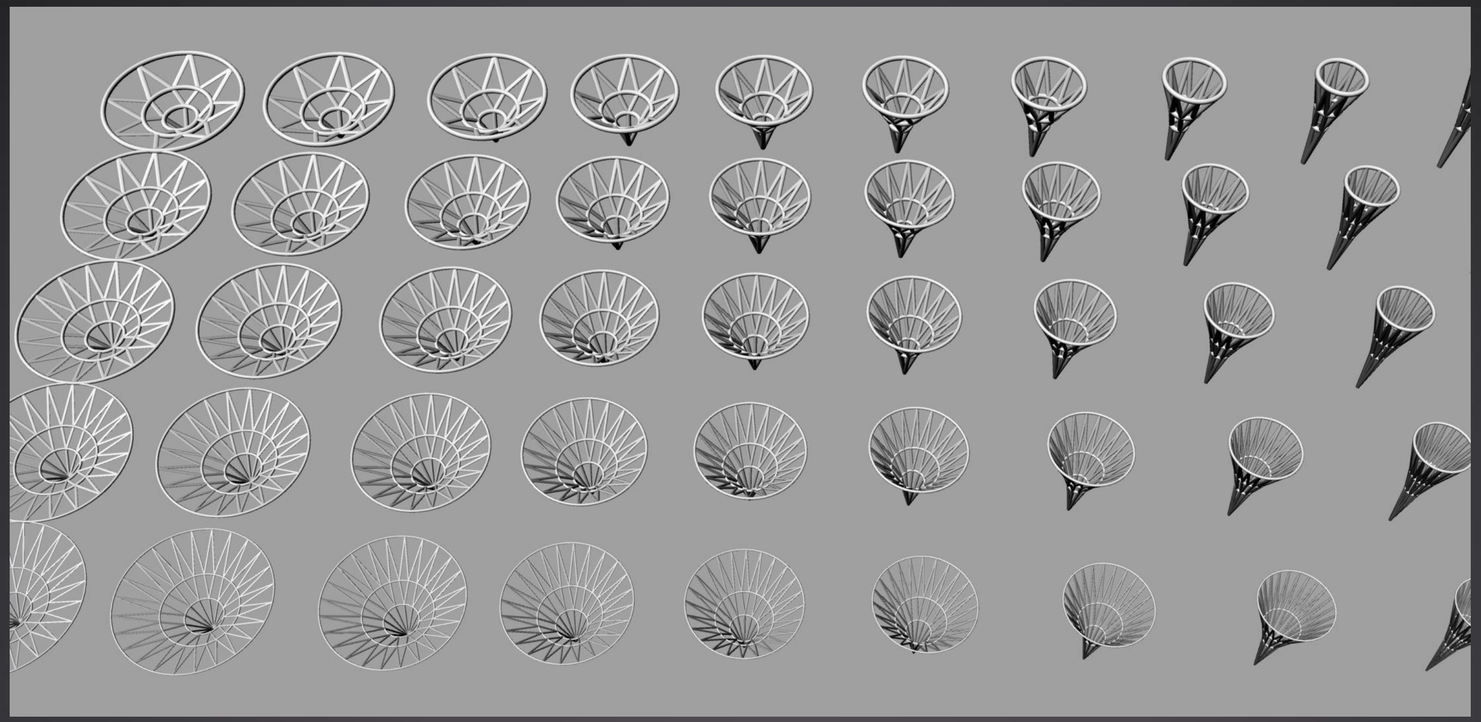
www.the3teacher.com

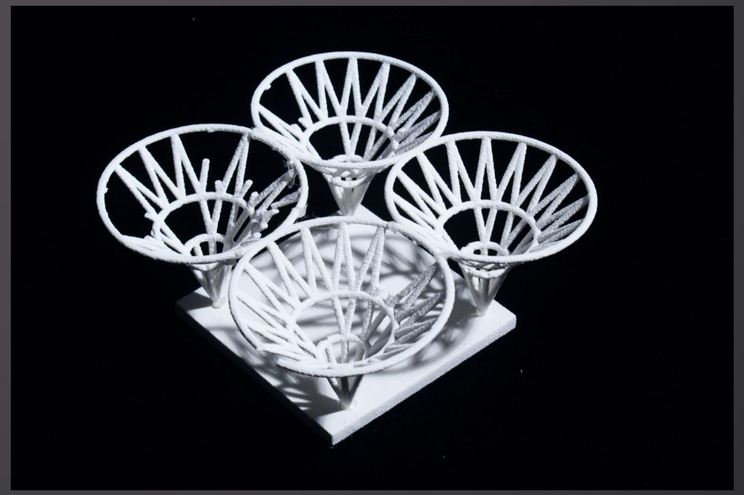
ARCHITECTURE

Bamboo Urbanism

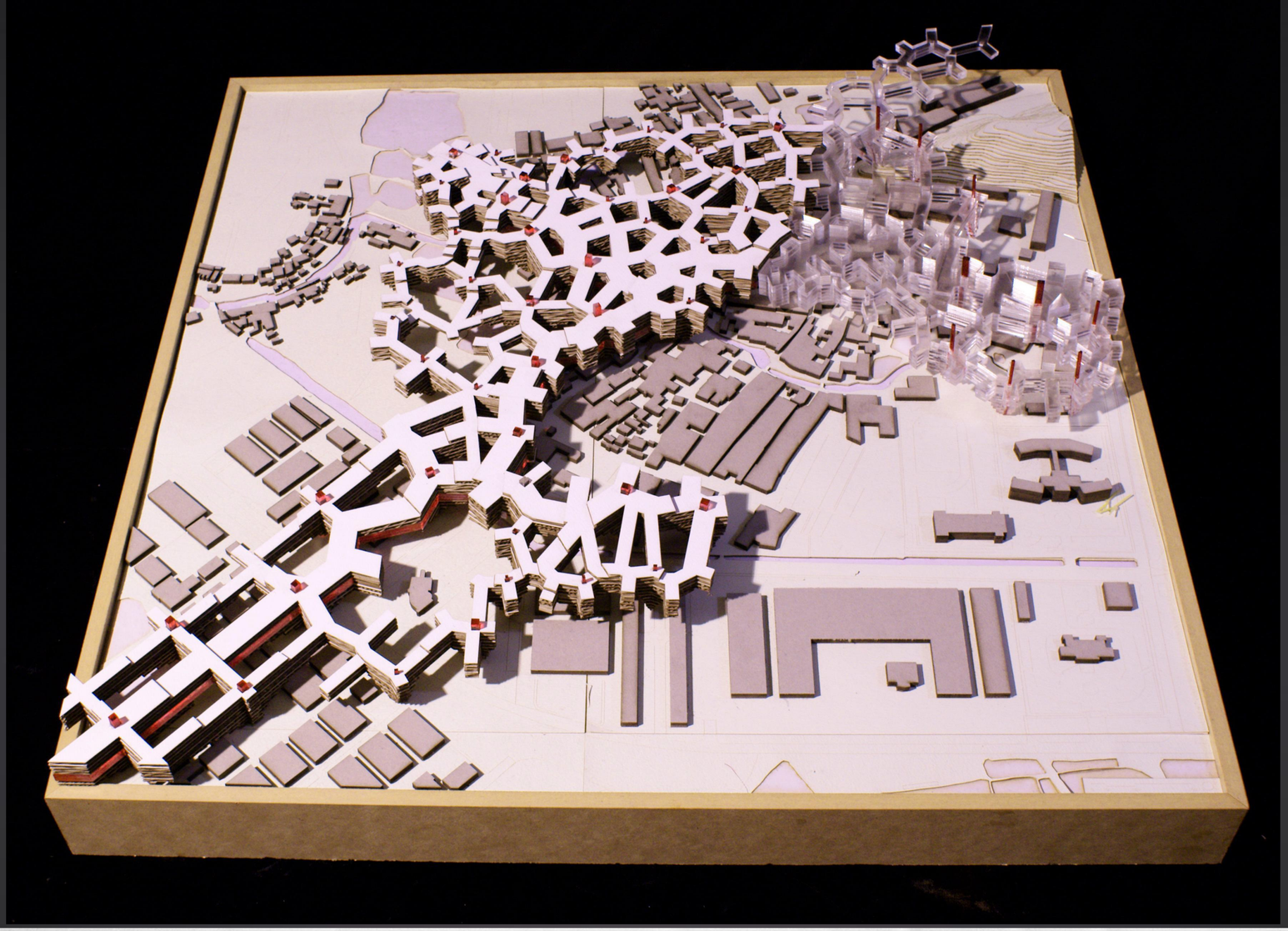
竹 樓

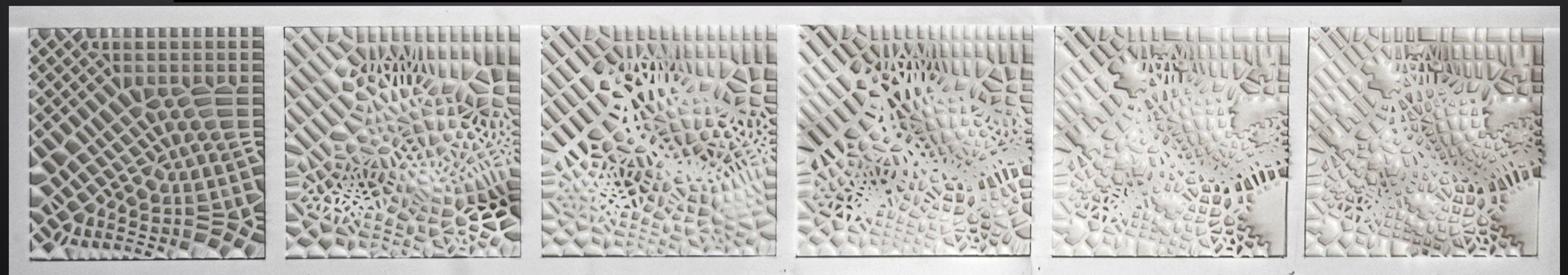
Champion for “Harmonized Neighborhood: Sustainable Building Design Competition ”
2009





Thesis Project
2009



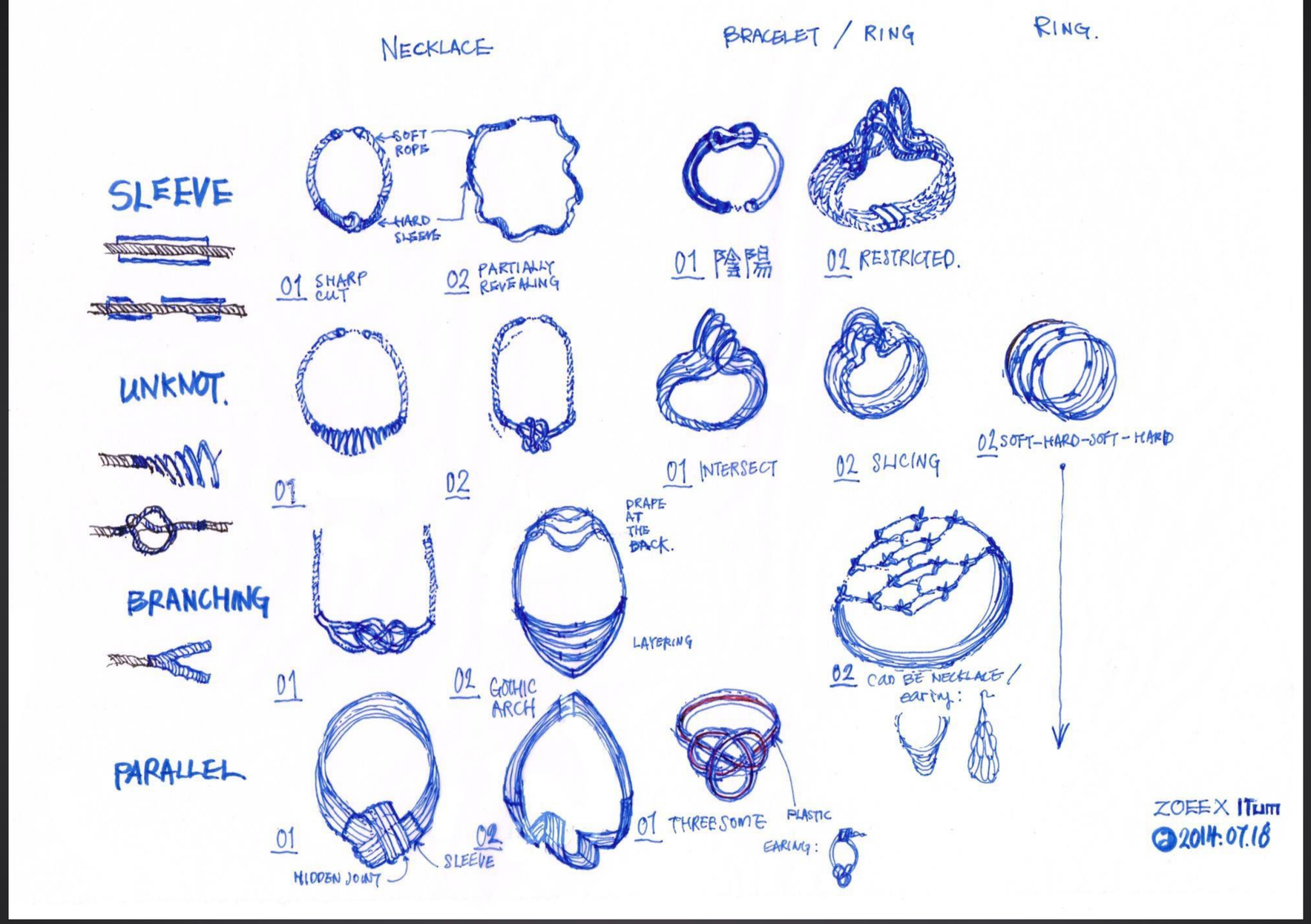


ROPE UNROPED

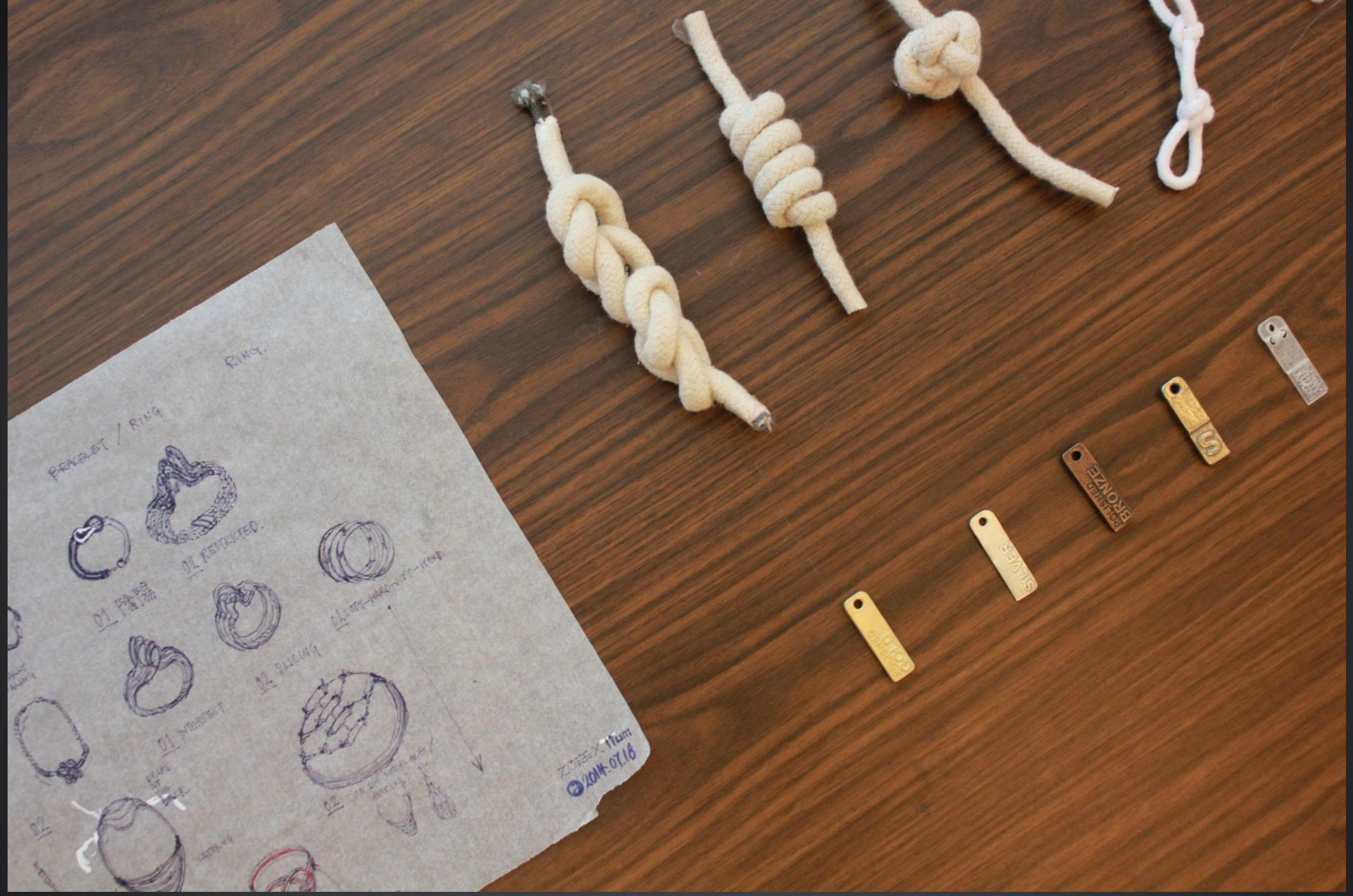
(In Collaboration with ZO-EE)

3D Printing X Handcraft

> ZO-EE’s signature style: Chunky Knots

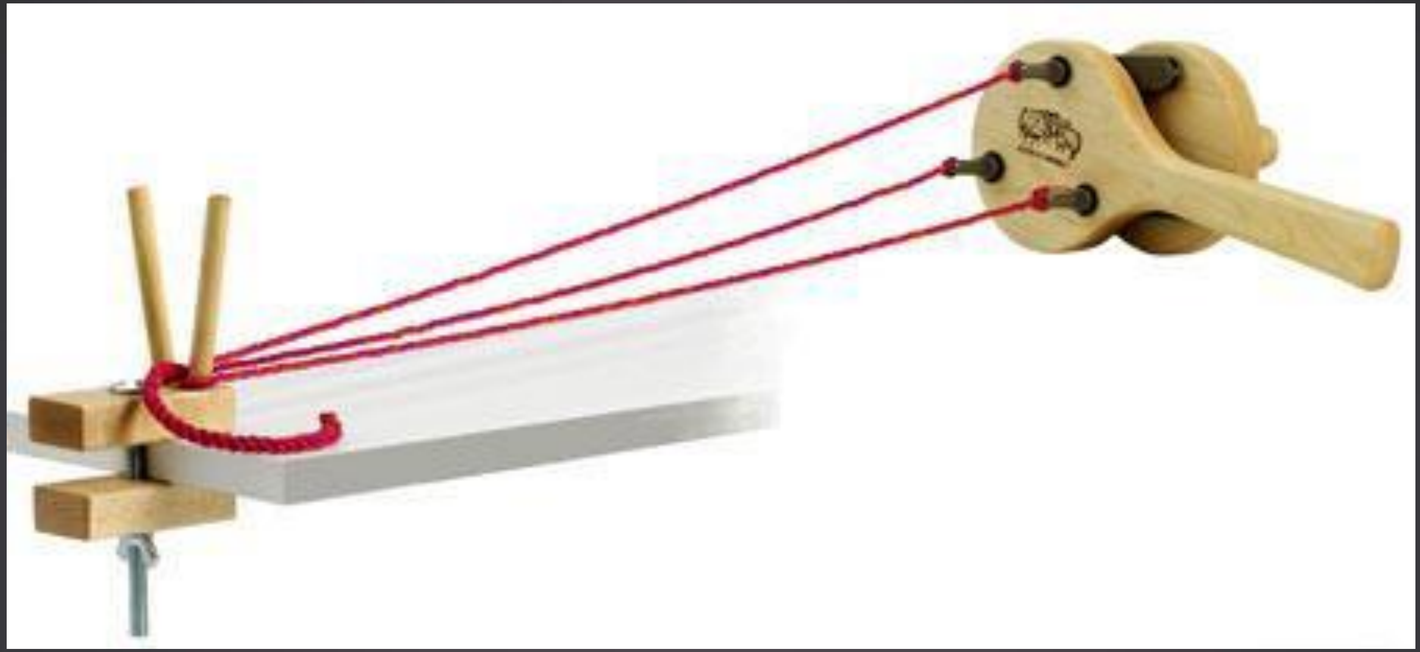

NECKLACE
BRACELET / RING
RING.
SLEEVE
SOFT ROPE
HARD SLEEVE
01 SHARP CUT
02 PARTIALLY REVEALING
01 陰陽
02 RESTRICTED.
UNKNOT.
01
02
01 INTERSECT
02 SLICING
02 SOFT-HARD-SOFT-HARD
BRANCHING
DRAPE AT THE BACK.
LAYERING
01
02 GOTHIC ARCH
02 CAN BE NECKLACE / earing:
PARALLEL
01
HIDDEN JOINT
SLEEVE
02
01 THREESOME
PLASTIC
EARING:
ZOEEX ITUM
2014.07.18

> Idea sketch



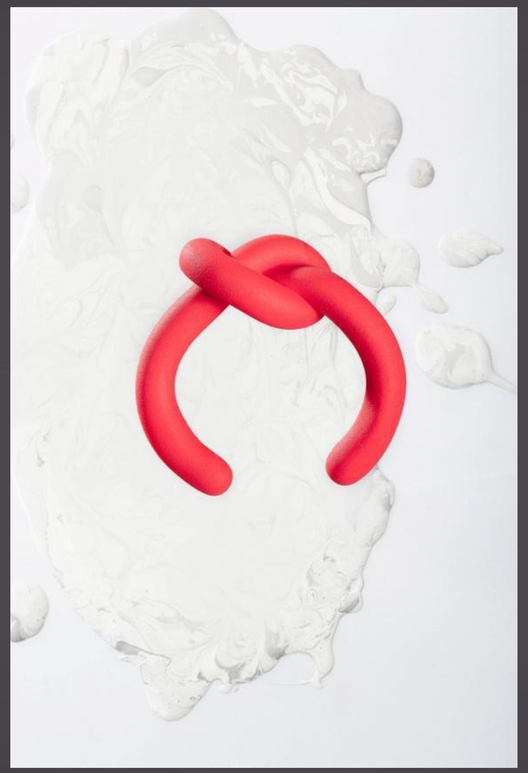
> Dialogue between two designers

> How a rope is made?



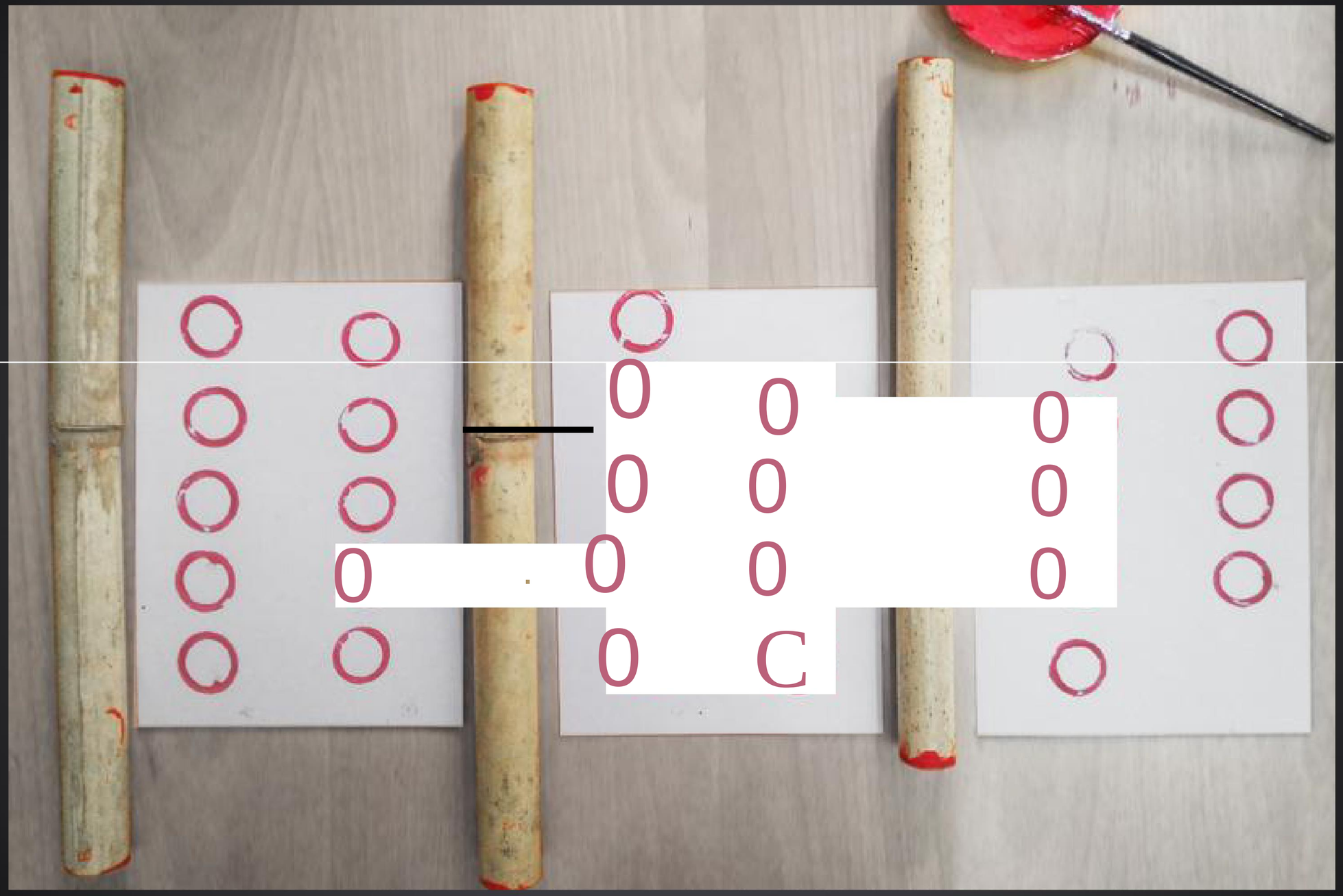
> By 3 bundles of twisted fiber

> A rope unropes itself and becomes a pendant shape



B+ STOOL

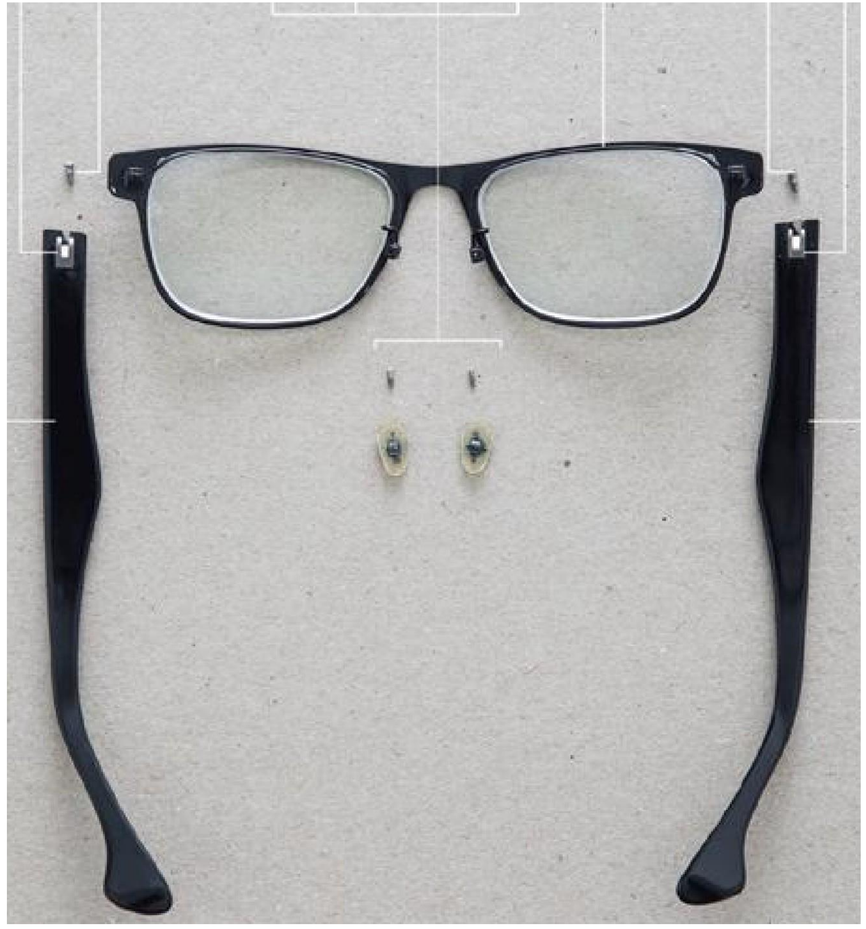
3D Printing X Upcycling



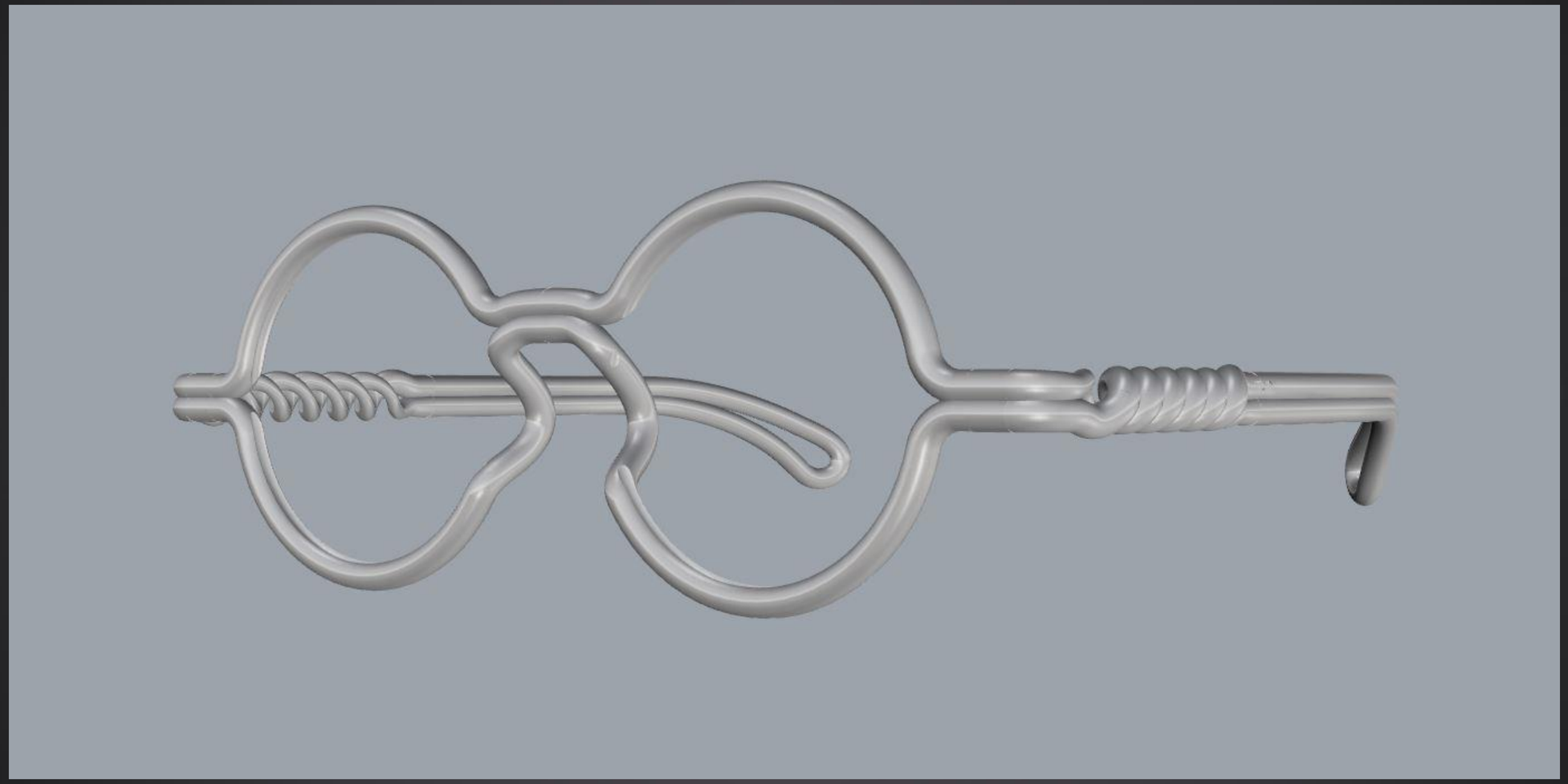
如何利用3D打印技術改良統眼鏡生產?

傳統眼鏡生產的問題

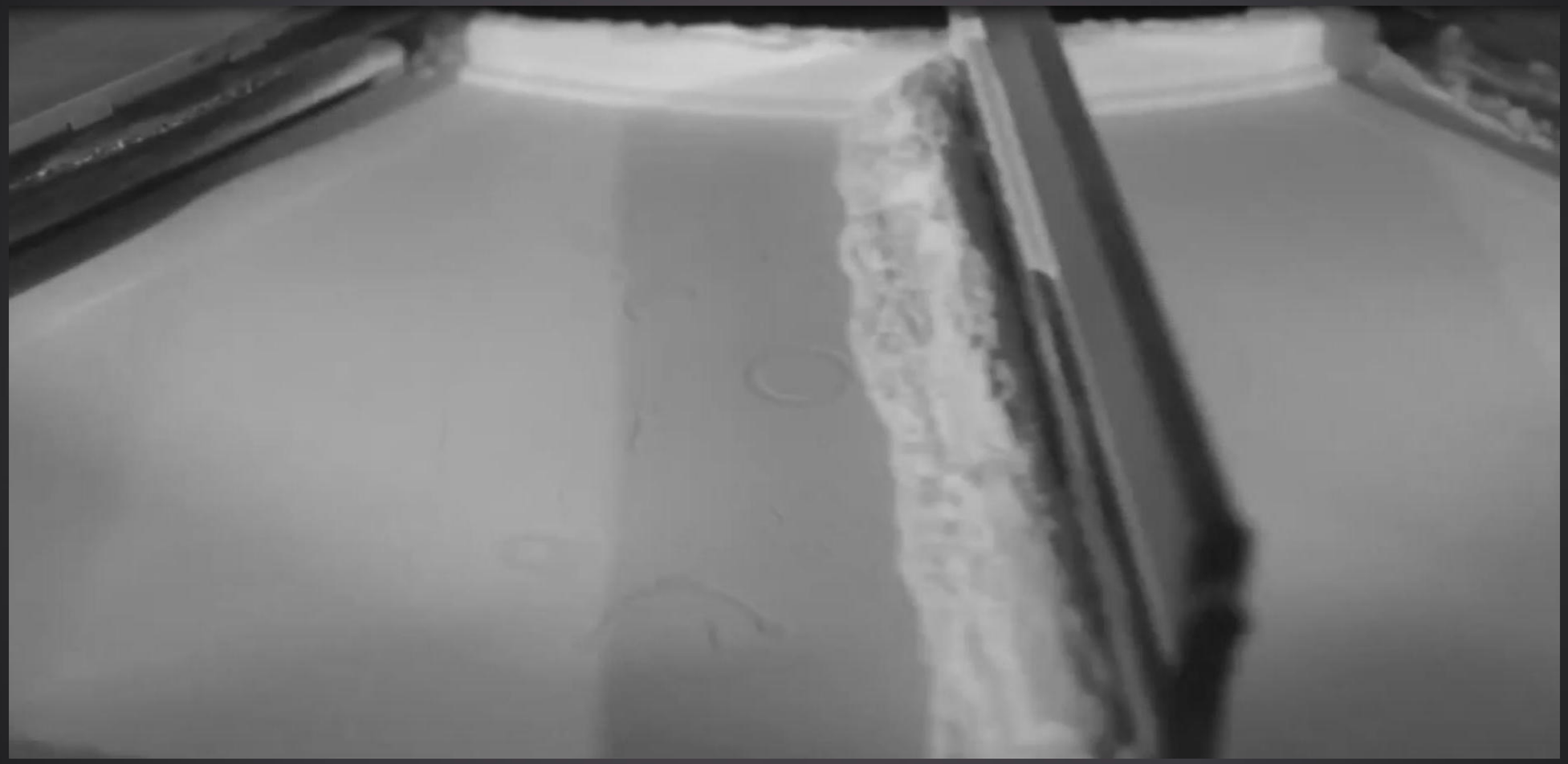
1. 大量機器
2. 大量人手
3. 大量浪費
4. 難以客制



> Reductive Manufacturing



> Data from a 3D model

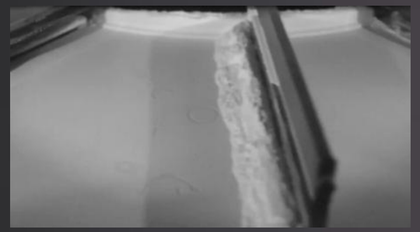


> SLS (Selective Laser Sintering) Printing

> Retrieving the products and recycling the raw materials

> Polishing

> Dyeing



3D Print

Clean

Polish

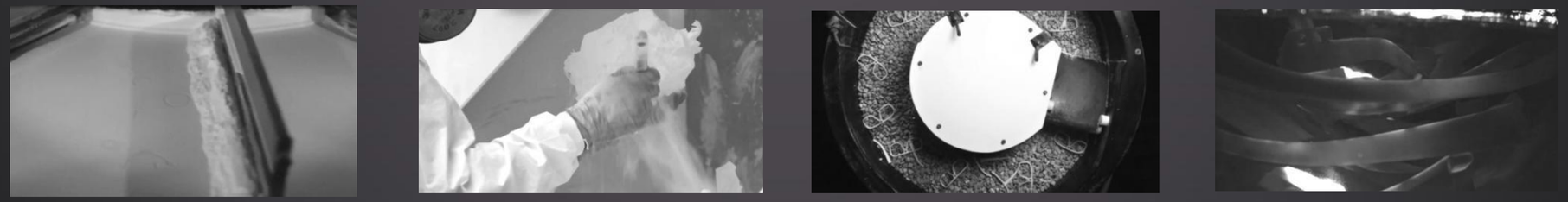
Dye

> Additive Manufacturing

Reductive Manufacturing

6 Steps

1 Step



Additive Manufacturing

1 2 3 4 5 6, 7 8 9 10 n

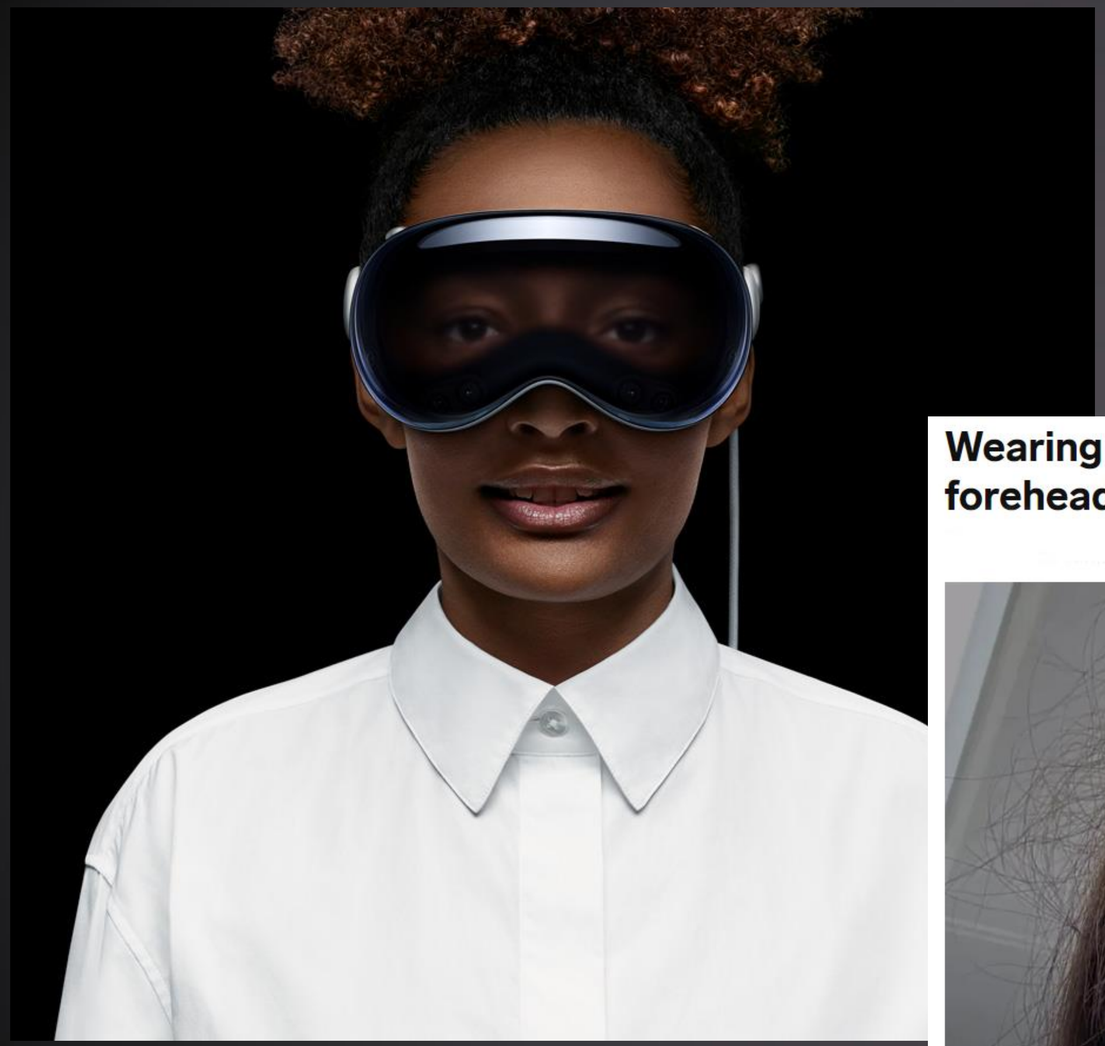
1

Advantages of 3D Printed Glasses

1. Small batch production
2. Freedom of form factor
3. Customization
4. Less Waste

MONO EYEWEAR

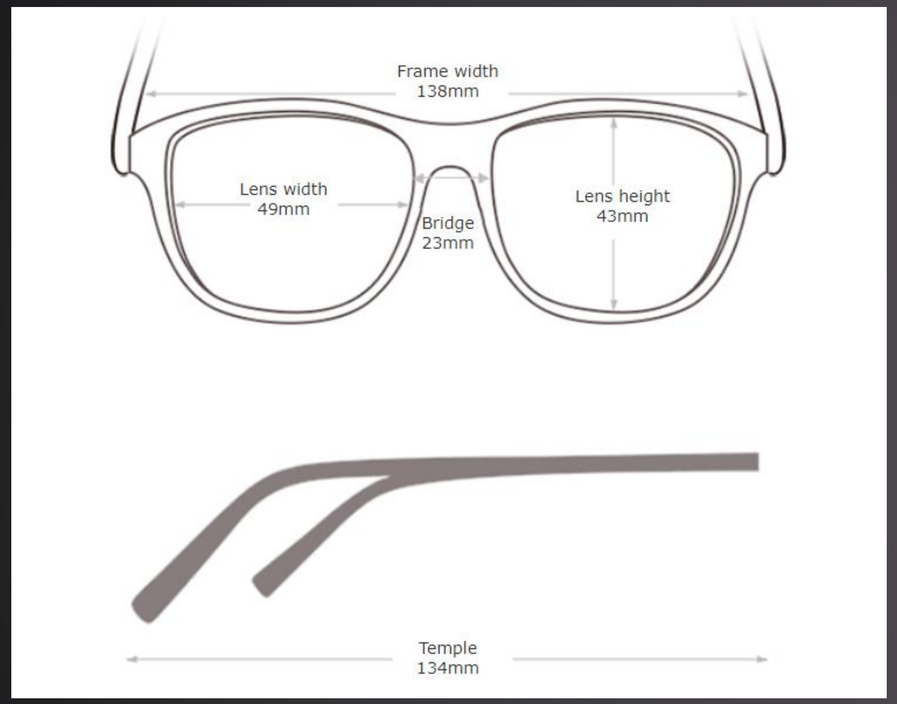
Erogonomic & Aesthetic

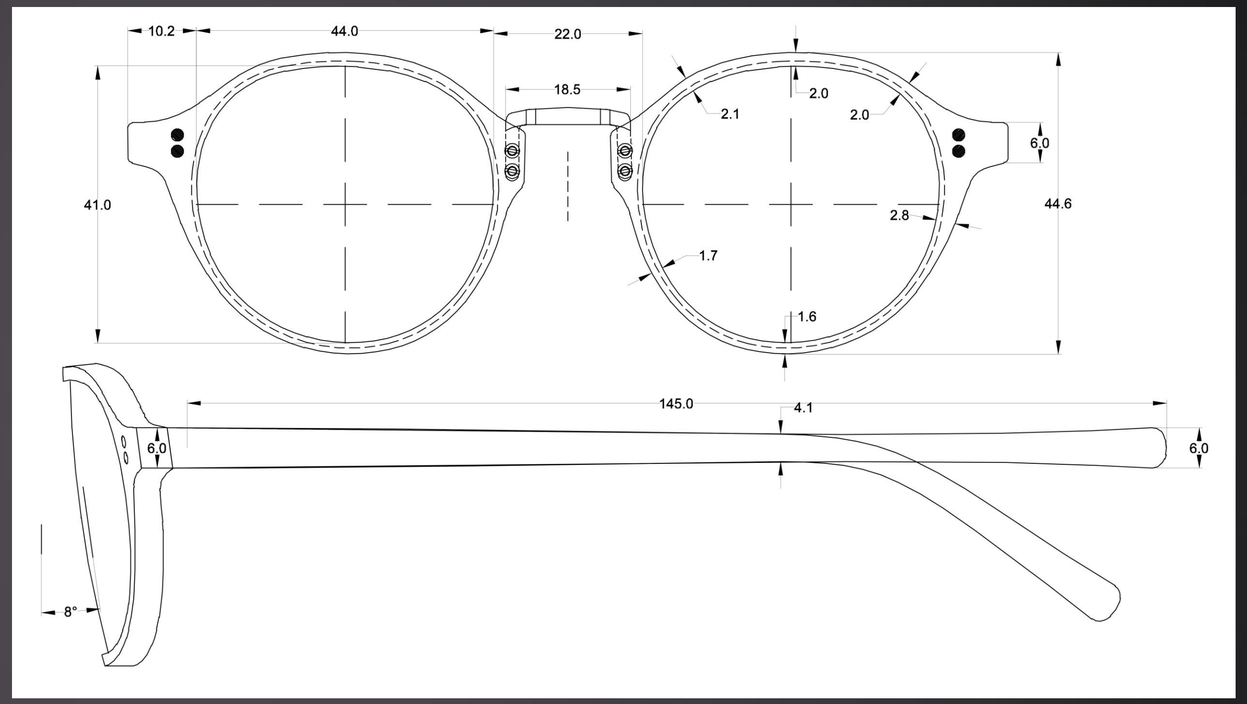


Wearing Apple's Vision Pro for 30 minutes put a big red mark on the forehead of WSJ's gadget reviewer

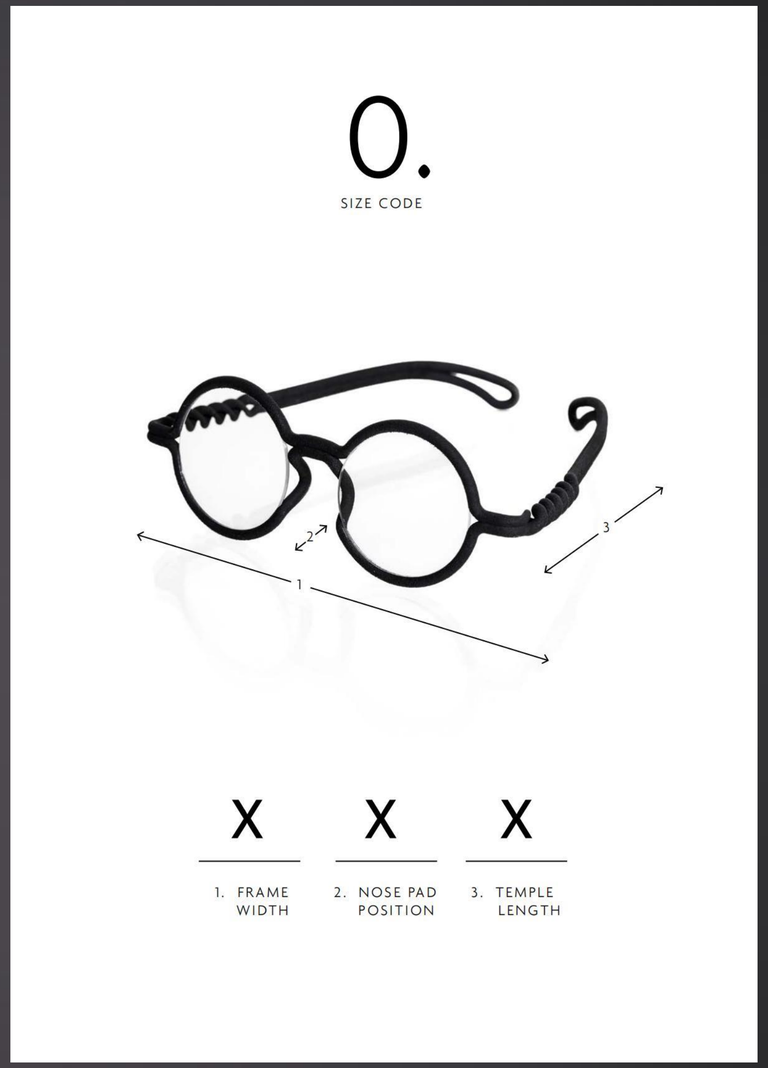
WSJ tech reviewer's forehead looks red after she wore an Apple Vision Pro WSJ/Joanna Stern/YouTube

> The importance of Ergonomic





> The importance of Ergonomic



> The importance of Ergonomic

1.

FRAME WIDTH

S / M / L

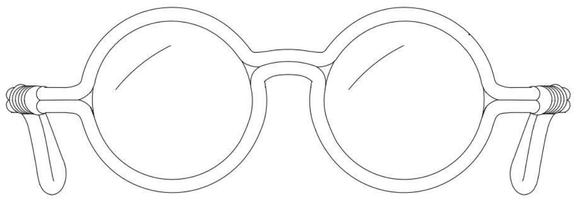
130MM	140MM	150MM

THE WIDTH OF THE FRAME IS MEASURED 50MM FROM THE FRONT,
THIS IS WHERE THE FRAME START TO TOUCH YOUR FACE.

S : FOR SMALL FACES, E.G. LADIES OR KIDS.
M : FOR AVERAGE FACES, E.G. CAUCASIANS.
L : FOR WIDER FACES, E.G. ASIANS.

2.

NOSE PAD POSITION



S / M / L

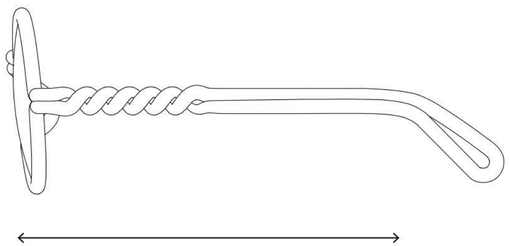
	10MM	13MM	13MM
DEPTH	15MM	15MM	10MM

THE WIDTH, WHICH IS THE CLEAR DISTANCE BETWEEN THE NOSEPADS,
AND DEPTH OF OF THE NOSE PAD VARY TO FIT DIFFERENT TYPES OF
NOSE BRIDGES.

S : FOR SHALLOW NOSE BRIDGES
M : FOR AVERAGE OR SHALLOW BUT WIDE NOSE BRIDGES
L : FOR HIGH NOSE BRIDGES

3.

TEMPLE LENGTH



S / M / L

105MM	115MM	125MM

THE LENGTH OF TEMPLE IS MEASURED FROM THE FRONT
TO THE TURN OF THE EARPIECE WHERE IT RESTS ON THE EAR.

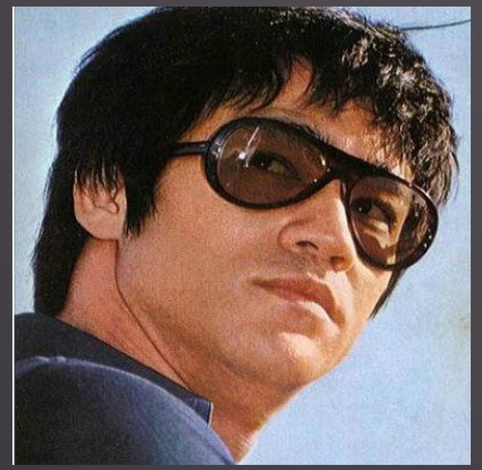
S : FOR SMALL OR FLAT FACES, E.G. KIDS.
M : FOR AVERAGE FACES, E.G. CAUCASIANS.
L : FOR BIG OR ROUNDED FACES, E.G. ASIANS.

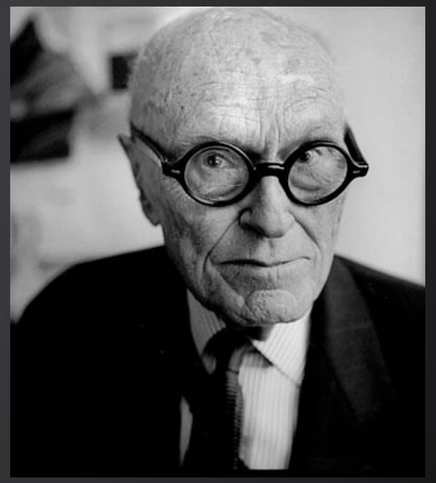
> The importance of Ergonomic

Tom Cruise in Top Gun Maverick 2022

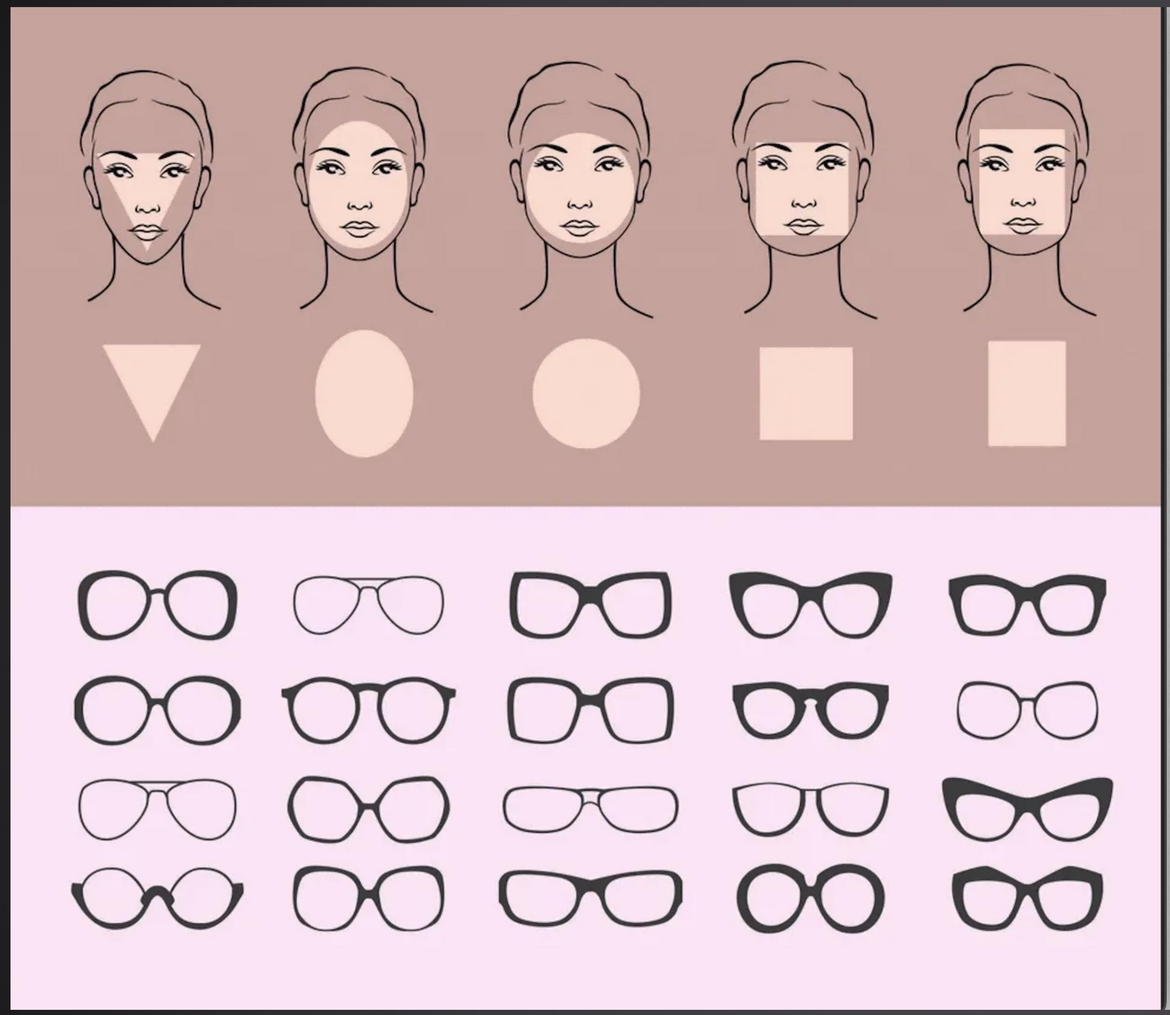
A cult classic, the movie was a huge success among the audiences. So much so that Cruise's U.S. Navy character boosted real-life naval recruitments by 500% after the movie's release. And owing to this insane success, almost 80 years after the incorporation of the company, Ray-Ban saw a whopping 40% increase in its sales, while linking the glasses with its military roots.

> The importance of Aesthetic





> The importance of Aesthetic



FACE SHAPES / FRAME STYLES	Long	Rectangle	Round	Square	Inverted Triangle	Heart	Rhombus or Diamond	Triangle	Oval
Aviators	✓	✓	✓	✓	✓	✓	✓	✓	✓
Wayfarer	✓	✓	✗	✓	✓	✗	✗	✗	✓
Browline	✓	✓	✗	✓	✗	✗	✗	✓	✓
Round	✓	✓	✗	✓	✓	✗	✓	✗	✗
Oval	✓	✓	✗	✓	✗	✗	✓	✓	✗
Geometric	✓	✓	✗	✗	✓	✓	✗	✓	✓
Wrap	✓	✓	✓	✓	✓	✓	✓	✓	✓
Rectangle	✗	✗	✓	✗	✗	✓	✗	✓	✓
Square	✗	✗	✓	✗	✓	✗	✗	✗	✓

> The importance of Aesthetic

MONO EYEWEAR

3D Printing X Mass Customization

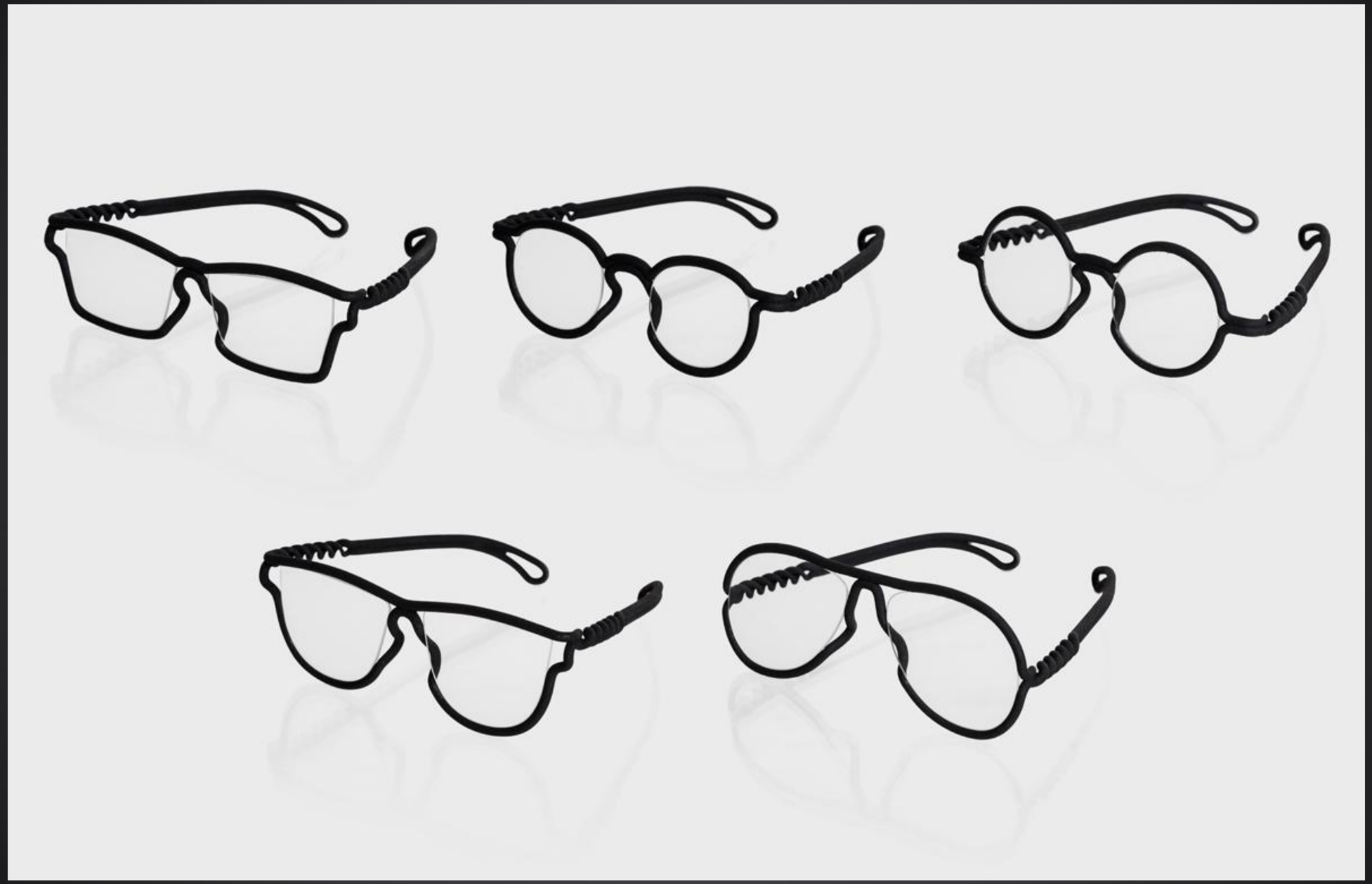
如果衣服鞋子都有尺碼可選，為何眼鏡没有?

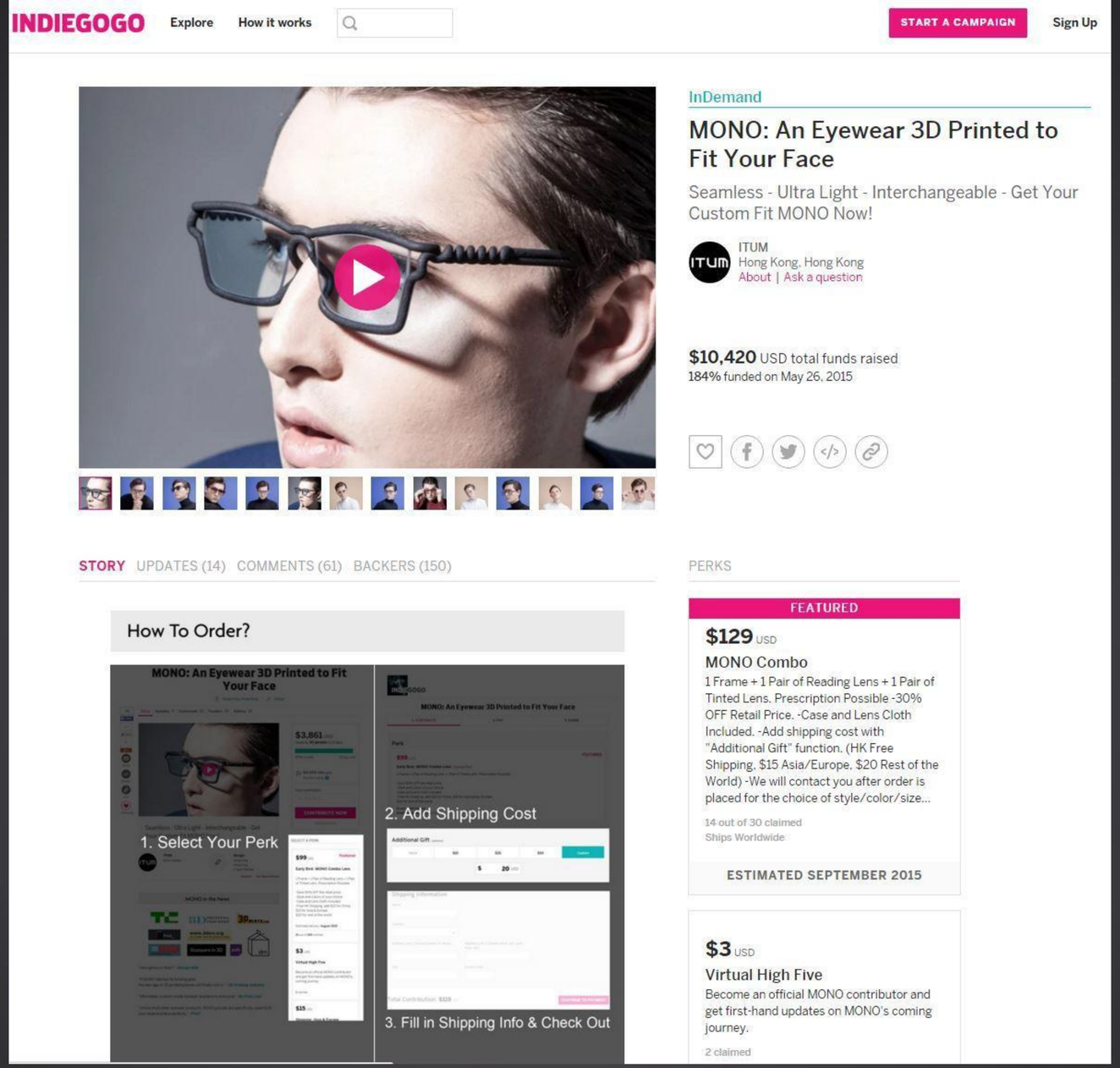
L M-M

1
WAE.
WD

2
NOSI!.!PA:D
W D

3
TEMPLE
LENGTH





> MONO is funded successfully by a crowdfunding campaign

MONO in the News

PROUDLY NOMINATED FOR

A MEMBER OF BACKERCLUB

"How genius is that?!" -**Design Milk**

"If MONO reaches its funding goal,
the new age of 3D printed glasses will finally kick in." -**3D Printing Industry**

"Affordable, custom-made eyewear available to everyone" -**3D Print.com**

"Unlike most other eyewear products, MONO glasses are specifically sized to fit your head and face perfectly." -**PSKF**

> The project has drawn international attention

TC News Video Events Crunchbase Search

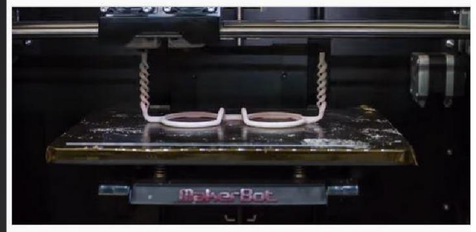
PARTY AT AUGUST CAPITA

111111111

See The Specs Restyled By 3D Printing

Posted Apr 21, 2or5 by Natasha Lomas (lIrlptari)

Next Story



The 30 printed future is looking increasingly c<1rtoonish if this crowdfunder tor one-piece flexible nylon eyewear is making a prescient design c.:ill. Called Mono, the designer specs look like they've been scribbled onto the model's face with a Sharpie marker

Hong Kong based drchitect Edmond Wong came up with the idea piece pair of specs that are printed in one go after having troublE finding glasses that fit He says he had existing experience using making architectural models so put the two together and came u for a range of 30 printed one-piece specs - bringing an optician

board for relevant experience.

The Mono design allows online buyers to be reasonably confiden across the range of styles and without trying the glasses on in pe

designs are sized across three points on each pair of glasses, eac

T.: NEWSLETTERS

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3D H.E:PYI.Ufiiffi ft; Wong

專訪 ITUM 創辦人 Edmond

撰好此文: 看喜好 分享 154

30 HflJH 5R ii!,& J:!-'YAA oJ..JAHHj): tMi, WliEIG a'.HJI i9 1A 3i-!:!;§,Gfl'.Jru!: tiffi&.fCrJE.? B unwirett ffl7iiffi 30HE/l5i:!trul: ;!ioom!'.!!•

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3Dmomlil . H:±J'8:..:

Edmond fnrul:H"fAlli.gfrl ffl 30HflJIli:li:a'JiiHI, Hffl:Z §Ga'J , rttffit!:11/U ;l, @ttlJl{iffi;i;M,IRl/t3itUIIYJ , fj At5'j;;, I I S 3 , ::t:.T , ffiiWiXEIGm t-iU• , !!!fH1 30 Hf!!!!!!Eaim iil (l::Jfftm:¥.fiM, ill Edmond @ il E M!!':illl!Ui!ffiil;fl:fil, r tm 30 tJE1Jt!!W.'t:li:f'r:J lU6'1!J-fi IBA/tl-ll , ;a fiSl, milli ·F 3D HffJl.Qlfrn J8ffl, HJ B /t&.lifl-.L , HJ Ui!!JI<li/i07 , lilo!cm-illJJHi, iliWil 3D HfJ:±leRInmil!c!e1'1Hfolli!!oimil!

競爭。」

About the Author

依莉詩

生活離不開科技，要玩轉不妨嘗試。

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KKBOX VS Apple Music

音質 歌種 功能

音質，歌種，功能比拼 – KKBOX vs Apple Music

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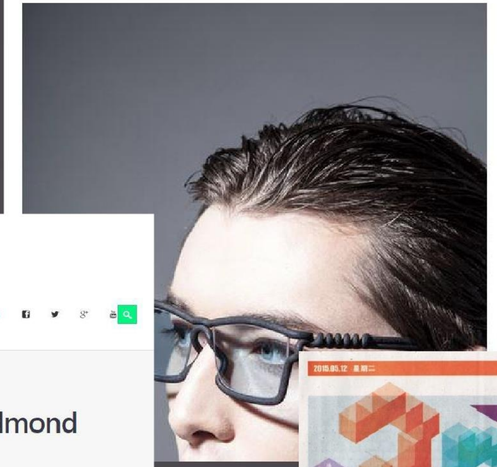
At.CfilTECTURE 1, ART 1, H01rE II,Jr.RIORS 't. STITLI. 1. TI.CH COLU 'II\"COLUMNS

PREVIOUS NEXT MOST POPULAR WEEK

MONO: GLASSES 3D PRINTED TO FIT YOUR FACE

Posted by Caroline Williamson on 04.30.16 in Man, Style + Fashion



THE SUPER-CONDUCTIVE LEXUS SLIDE HOVERBOARD

A MODERN EXTENSION & RENOVATION OF A VICTORIAN RESIDENCE

太陽報 THE SUN 大搜查 A16

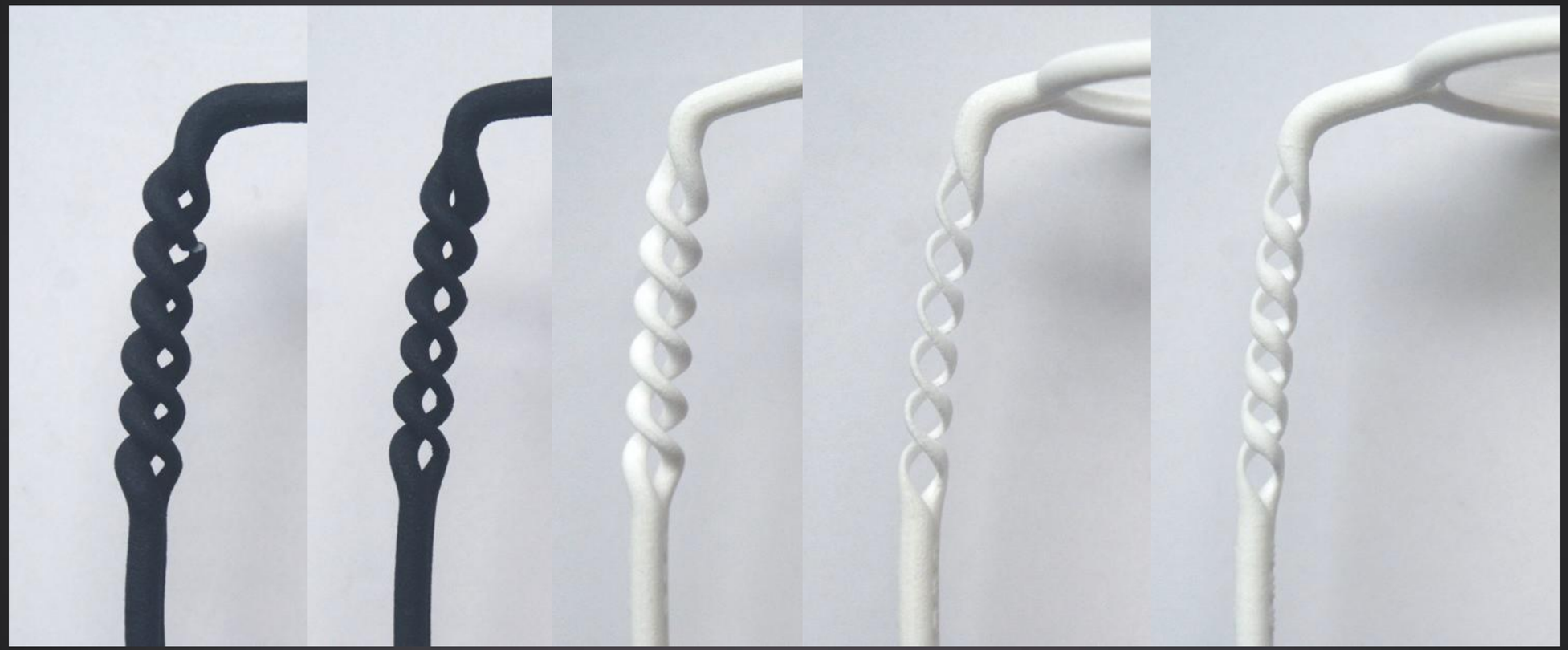
不忿難揀尺碼 網上集資創業

3D打印Fit眼鏡 建築師賣眼鏡

全城大搜查

「明擔憂計劃」

調查三萬元省招牌



ITUM

The United States of America

The Directorof the United States Patent and Trademark Office

/-fas received an application for a patent for a new, original, and ornamental design for an article of manufacture. The title and descrijJlion of the design are enclosed. The requirements of law have been complied ll'ith, and it has been determined that a patent 0l1 the design shall be granted under the law.

Therefore, this

United States Patent

Grants to the person(s) having title to this paten/ the right lo exclude others from mak ing, using, offering for sale, or selling 1he de ign throughout the U11iled States of America or importing the design into the United States of America for the term el forth hy Im,:

Joseph Matal

Performing the Functions and Duties of the Under Secretary of Commerce for Intellectual Property and Director of the United States Patent and Trademark Office

US009772507B2

(121 **United States Patent**
Wong

(to) **Patent No.: US 9,772,507 B2**
(45) **Date of Patent: Sep. 26, 2017**

(54) SPECIACLE I<llAM.E WITH 1\TERI'W1 I:^G IIELLX JOll>TS AND NOSE PAD STRUCTURE TO FACJLTTATE JNTRRCHAKGI°G OF LRNSF.S

(71) Applicc:mt: Chak Yuen Wong, Ilong Kong (IIK)

(72) Inventor: Chak Yuen Wong, Hong Kong (HK)

(i,) Notice: Subject to any diselaimer, the term of this patent is extcnded or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No 15/055,447

(22) Filed: Feb. 26, 2016

(65) Prior Publication Data

US 2016/0266401 Al Sep. 15, 2016

Uclakd l!.S. Applicutiun Data

(60) Provisional application No. 62/132,539, filed. on Mar. 13. 2015.

(51) lot.Cl.

G'll2C	5/14	(2006.01)
G02C	1/08	(2006.01)
G'll2C	5/22	(2006.01)
G02C 5/16		(2006.01)
CI02C 5/I/2		(2006.01)
CI02C 5/00		(2006.01)

(52) U.S.Cl.

CI'C (;://2C 1I118 (2013.01); (;://2C 512272 (2013.01); CI02C 5/00I/ (2013.01): G02C 5/12 (2013.01); G02C 5/146 (2013.01): G02C 5/16 (2013.01); G02C 2200/10 (2013.01)

(58) .Fidd of Classification Search

CPC ..... G02C G02C (i02C 1/08; G02C 2200/10; 5/12; G02C 5/'43; G02C 5/146; G02C 5/2272

USI'K' ... 351/92, 90, 93, 95, 98, 99, 100, 101. 111. 351/116. 153. 124. 131132. 83. 41; 16/228

See application tile for complete search history.

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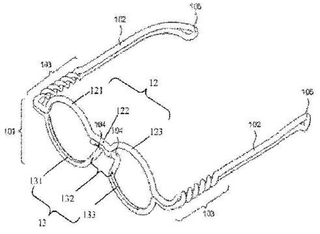
* cite<l hy examiner

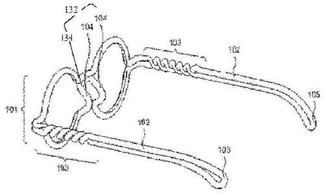
Primary Examiner - Hung Dang
(74) *Attorney. Agent, or Firm* - \V,1yne & King LLC

(57) ABSTRACT

This paLenl application relates lo spectacles or spectacle frames with .intertwining helix joints and a no8e pcLL portion I.o facilit.:.Lte an interchanging of lense8 of the spectades. '111e helix joint allows the temples to move into a folded position. lhe nose p:id portion provides an access portion for demch ing and/or attaching the lenses.

19 Claims, 4 Drawing Sheets





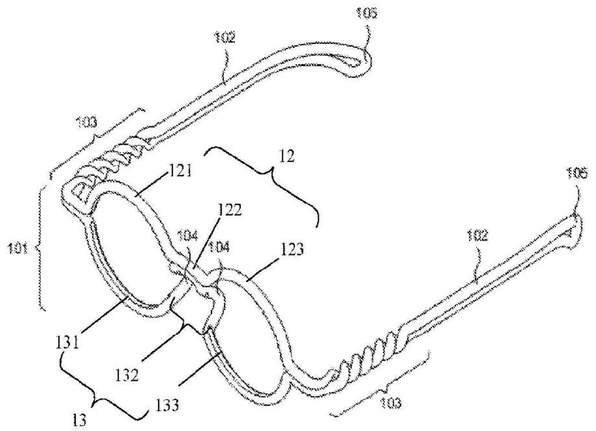


FIG. 1

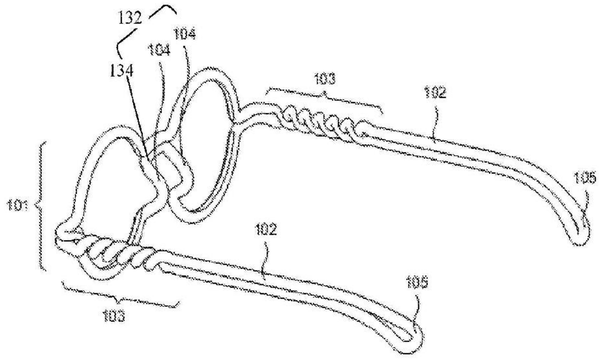


FIG. 2

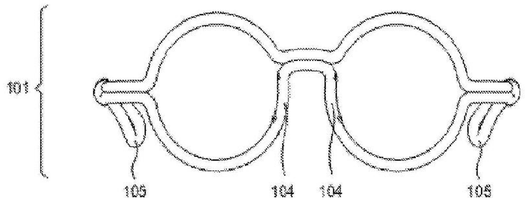


FIG. 3

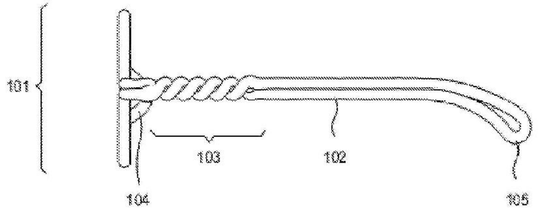


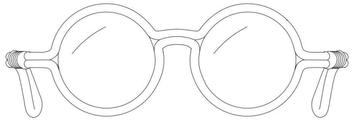
FIG. 4

WORKSHOP

Design Your Own Glasses

2.

NOSE PAD POSITION



S / M / L

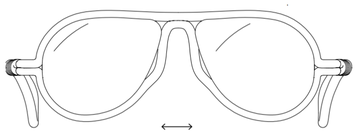
	S	M	L
	10MM	13MM	13MM
DEPTH	15MM	15MM	10MM

THE WIDTH, WHICH IS THE CLEAR DISTANCE BETWEEN THE NOSEPADS, AND DEPTH OF OF THE NOSE PAD VARY TO FIT DIFFERENT TYPES OF NOSE BRIDGES.

S : FOR SHALLOW NOSE BRIDGES
M : FOR AVERAGE OR SHALLOW BUT WIDE NOSE BRIDGES
L : FOR HIGH NOSE BRIDGES

2.

NOSE PAD POSITION



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DEPTH	15MM	15MM	10MM

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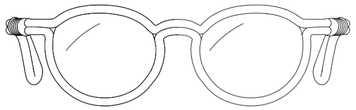

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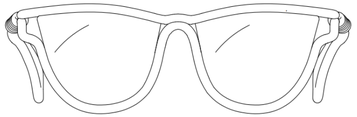
NOSE PAD POSITION



S / M / L

	S	M	L
	10MM	13MM	13MM
DEPTH	15MM	15MM	10MM

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