Choosing the Right 3D Printer:

What You Need to Consider Before Buying

An overview of 3D printing Technologies

What you will learn?

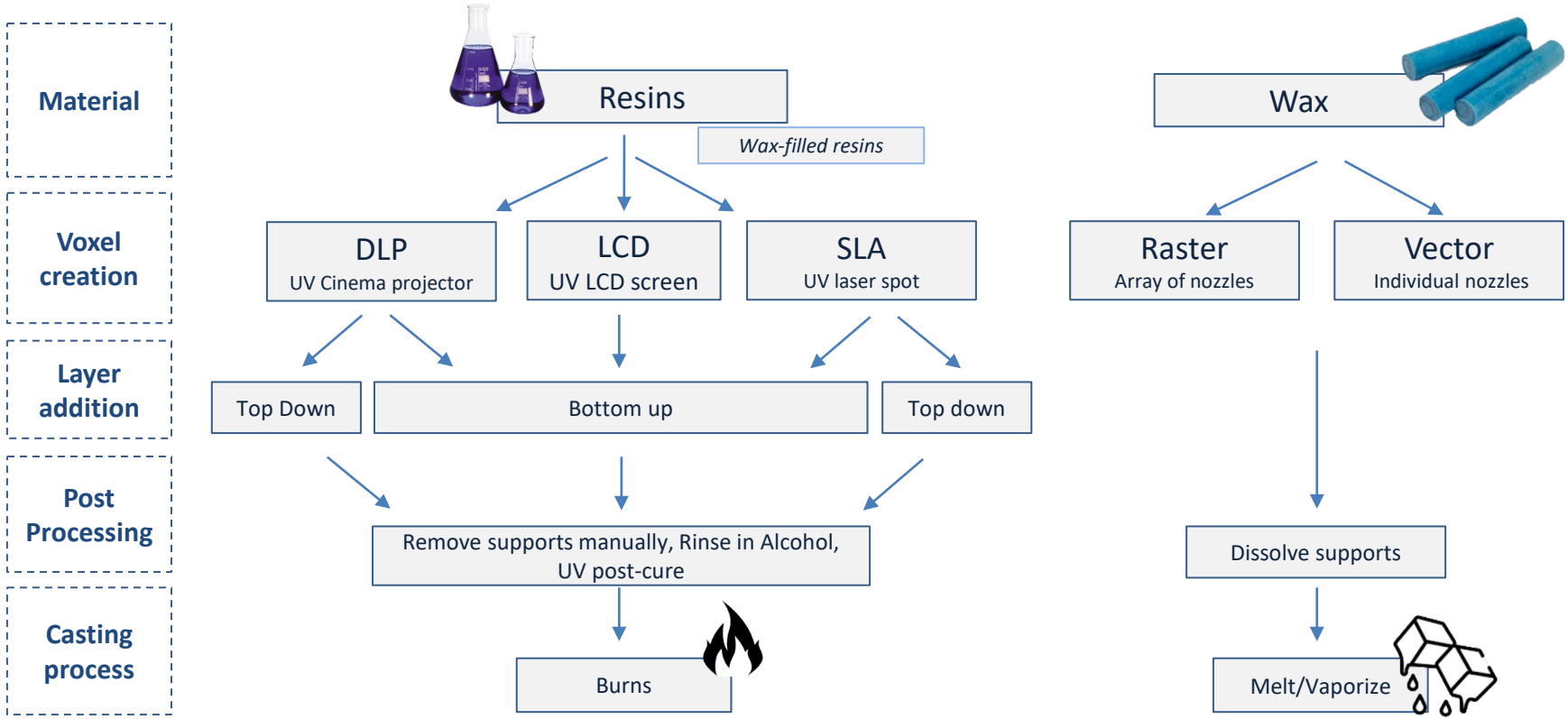
- What are the different printing technologies
- What are the different materials
- How does is relate to the final part
  - Surface finish
  - Casting results
  - Does it match my model
  - How much details
- How much does it cost?

About the speaker:

Vincent Icart has been working in 3D printing for more than 5 years as a technical expert and product leader.

Specialized in resin systems, Vincent has accompanied hundreds of customers in their deployment of 3D printing for Jewelry, dental, aeronautics and other applications

3DPrinting for jewelry… an array of technology



Before we start: Resolution, accuracy, precision

Resolution: ☐ High ☑ Low
Accuracy: ☐ High ☑ Low
Precision: ☑ High ☐ Low

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Resolution

What is the minimal feature size the imagery/voxel creation system can render

Expressed as dpi or Pixel size: 600dpi ⇔ 40µ pixel

Accuracy

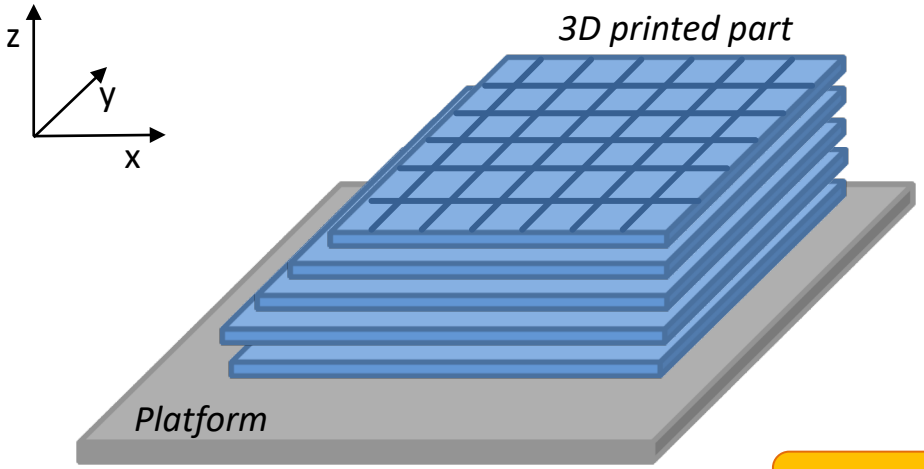
Is this feature correctly positioned?

Expressed as variation to target: ± 0.2% or ± 2 mil/inch

Precision

Is this feature always correctly positioned?

Before we start: Layer thickness, X/Y resolution



Layer thickness

Layer thickness depends on the material delivery system and platform movement.

Layer thickness = z resolution

X-Y resolution

Depends on the lighting / voxel creation

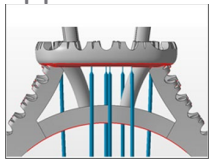
Layer thickness and X/Y resolution are usually not the same. As a result, the resolution of your printed part depends on the build orientation

Technology comparisons

Resin vs Wax

Resins

- Solidified by UV light
- X/Y resolution depends on the imaging system:
  - Pixel Grid: small pixel = high resolution = small build envelope
  - Laser: small spot = high resolution = small speed
- Need to build lattice structure supports
- Stronger parts



- Burn-out
  - Expands before burning: potential cracks
  - May leave some ashes (“ash residues”)
  - More smoke

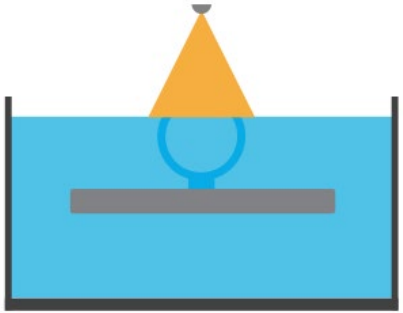
Wax

- Deposited by droplets
- X/Y resolution depends on the droplet size: small drops = high resolution = low building speed
- Materials is jetted, system generated support
- Can be fragile to manipulate

- Burn-out
  - Same as injected wax
  - No residues

Resin: printing direction

Top Down



- Light is above the resin
- Step by step Z-motion

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- With moving projector: very large build envelope

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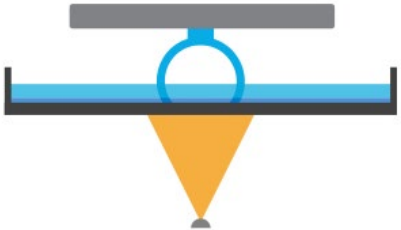
- Increased Capex: Requires a vat fill
- With laser: skew effect in the corners

Bottom Up



Credit: https://theorthocosmos.com/

- Light is just under the vat
- Step by step Z-motion

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- Small build platforms: ~5-10 pcs per print
- With Oxygen: reduced layer lines

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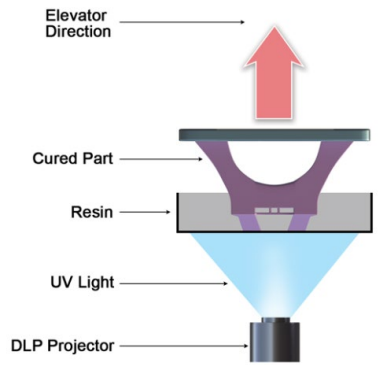
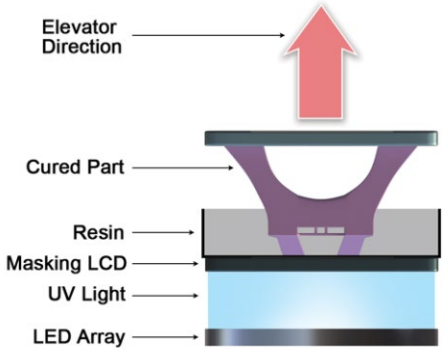
- Increased operating Cost: Vat ages and is a consumable
- With oxygen: Challenging on large sections
- With laser: skew effect in the corners

Resin: imaging technologies

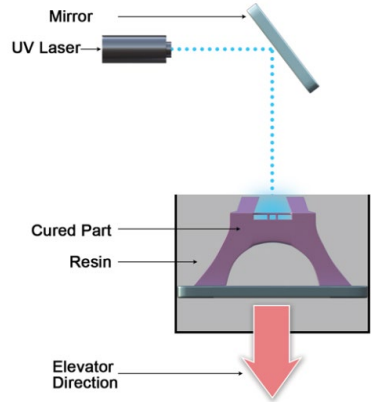
DLP



LCD



Laser



Credit: https://www.aegisdentalnetwork.com/idt/2018/03/redefining-the-dental-laboratory-workflow-with-3d-printing

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- High detail option: Pixel size can be made small depending on optics
- High accuracy

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- Capex: 4K DLP (from e-cinema) and high power UV LED are expensive
- Rougher surface: pixel effect

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- Faster: Multiple light sources can bring more energy
- Inexpensive: LCD are manufactured in billions

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- Pixel size comes for smartphone/ tablet industry (> 2 mils)
- High operating cost: LCD ages and needs to be replaced
- Rougher surface: pixel effect

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- High surface finish

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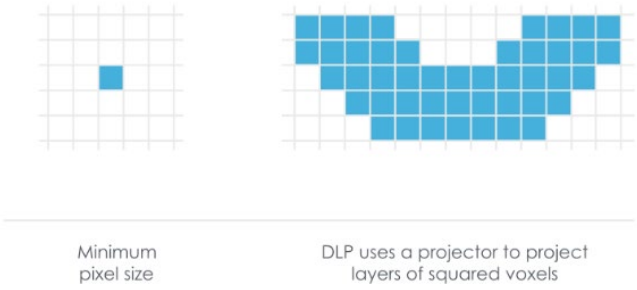
- Very slow: one voxel at a time
- Can deviate over time

Resin - imaging technologies: impact on surface finish

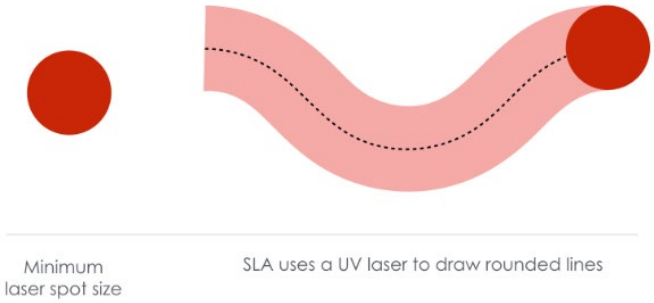
DLP / LCD



- High Resolution: can draw smaller details, text, engravings
- High speed: one illumination for all the image (stamp effect)

− Lower surface finish: pixel jump effect

Laser



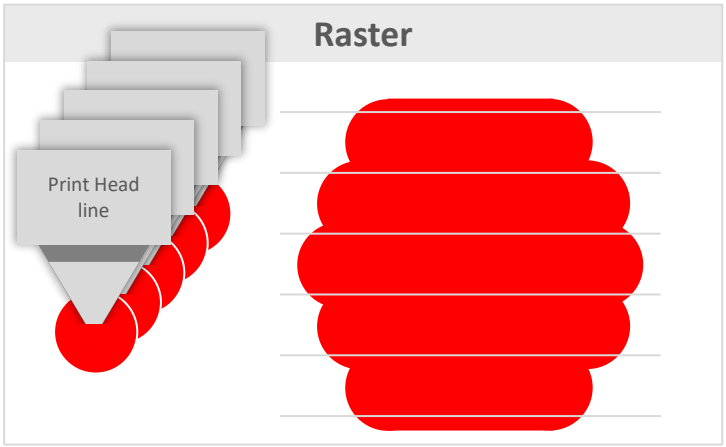
Credit: https://theorthocosmos.com/

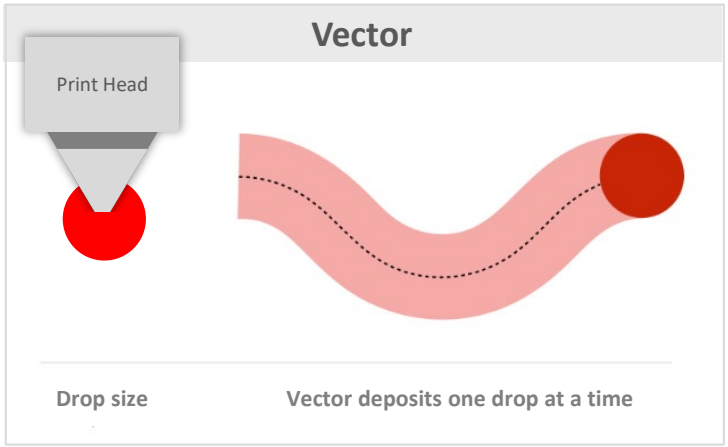
\+ High surface finish

− Very slow: one voxel at a time (pencil effect)
Poor resolution

There is no point in having tiny pixels (e.g. 1mil) or a smooth laser if your layers are very thick (e.g. 2 mils). Make sure X, Y and Z resolution are similar!

Wax: printing technologies





Credit: https://theorthocosmos.com/

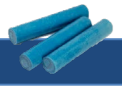
\+ High speed: multiple drops in one pass

\- X/Y are not equivalent in surface finish (sweep lines)
"Pixel effect" with on-off jetting

\+ Exact geometry (no sampling)
Very high surface finish allowing for less metal polishing

\- Slow: one drop at a time (pencil effect)

Overall Mapping



	Resins			Wax	
	Moving DLP	**DLP**	**LCD**	**Wax Raster**	**Wax Vector**
Unit size	Large floor unit	Desktop	Desktop	Large floor unit	Desktop
Key Benefits	▪ Best productivity ▪ High details	▪ Quick small prints ▪ Details	▪ Quick small prints ▪ Cheap	▪ Similar casting process ▪ Larger build envelope	▪ Best castability ▪ Unmatched surface finish, details and precision
Limitations	▪ Optimal for large volumes	▪ Lot of small prints	▪ Fragile LCD ▪ Limited resolution	▪ Optimal for large volumes ▪ Slow	▪ Speed
Typical applications	Mass production of jewelry in a record time	Quick prints in the design phase, prototype printing	Quick concept prints	Wax production on site. Good speed/quality compromise	Best-in class prints for ultimate precision and any metal casting
One word summary	Productivity	"One-of" prototype			Zero-compromise solution