Supplementary Materials

The future of software-controlled cooking

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Contents:

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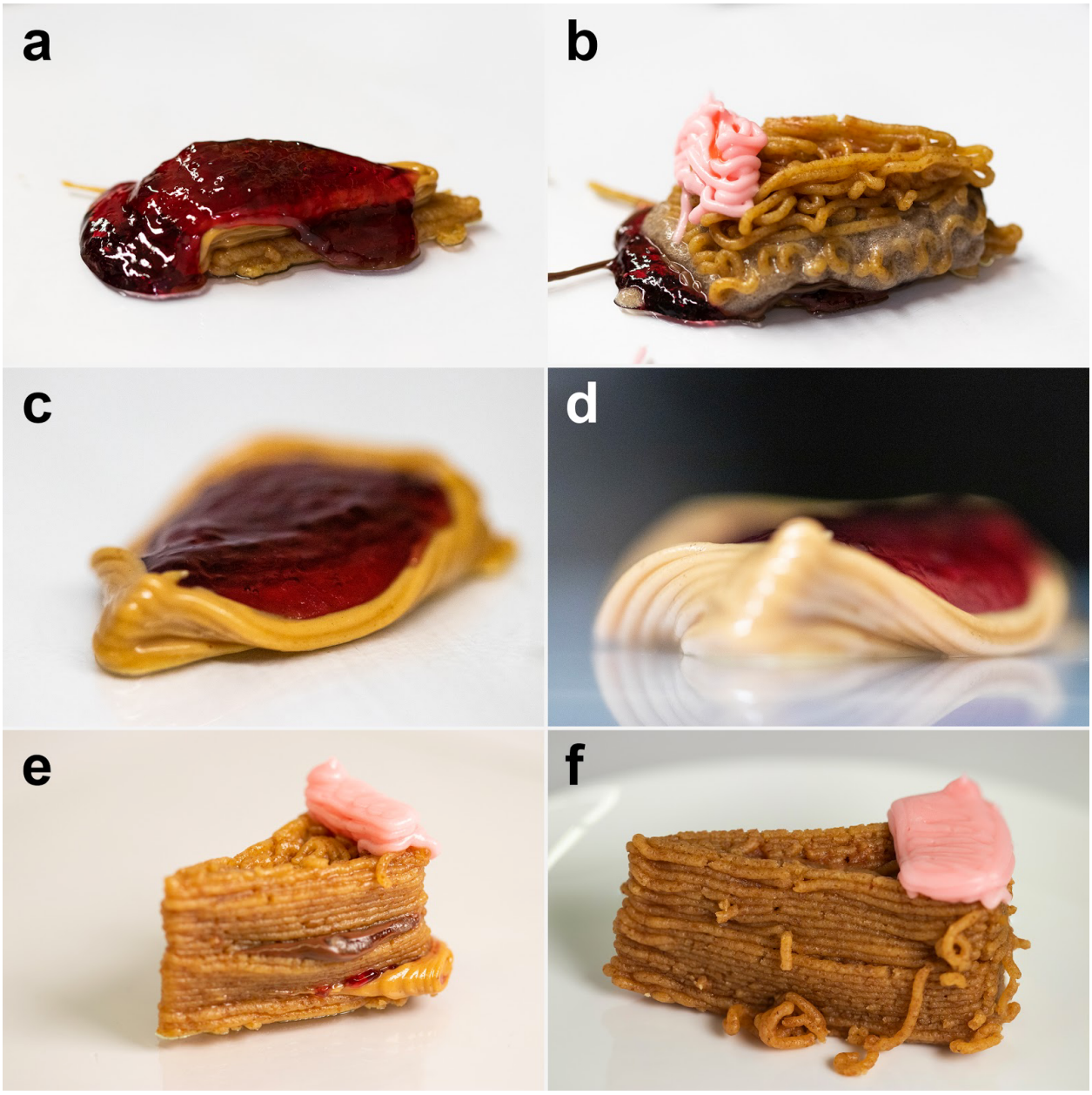
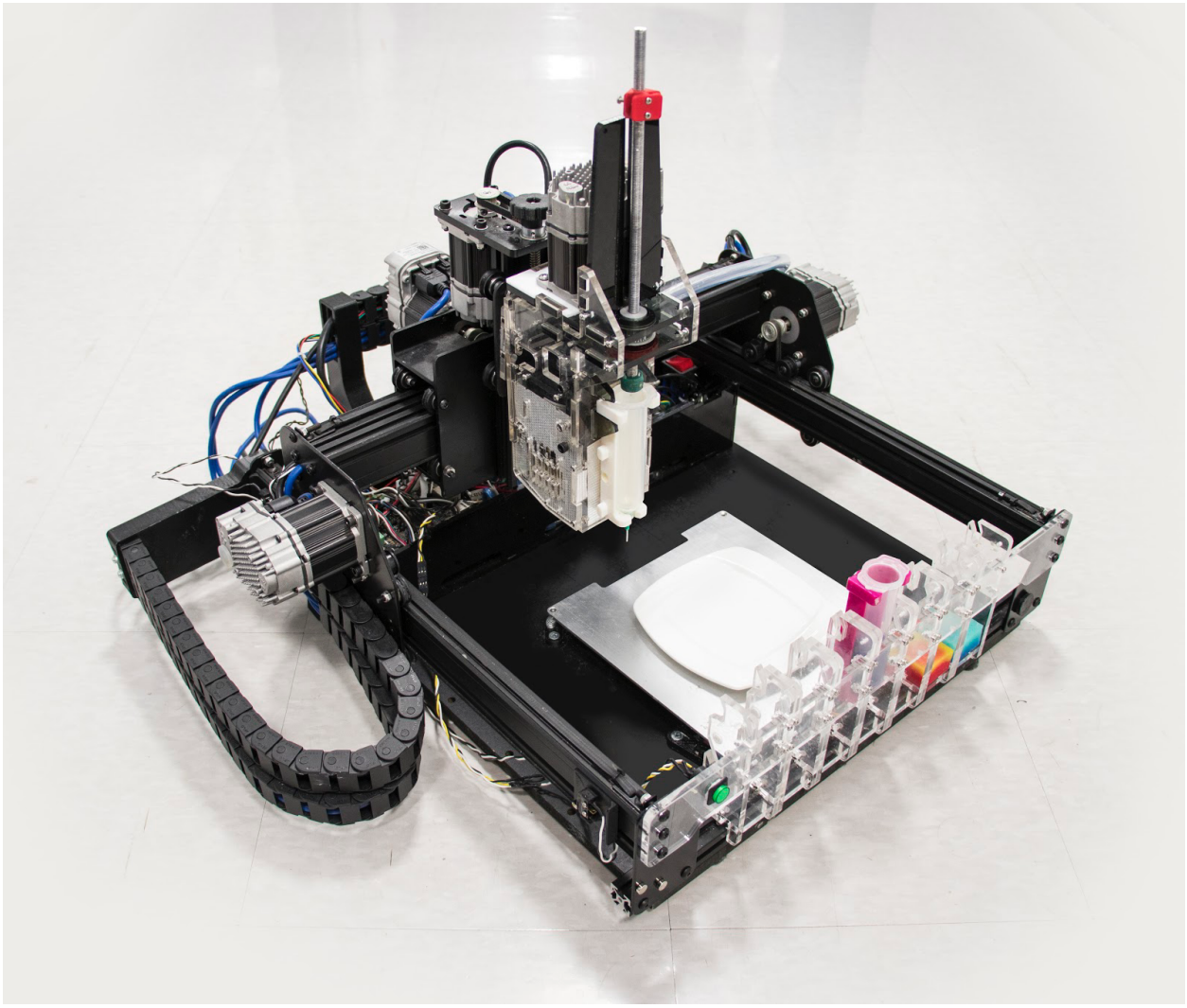
File name: Supplementary Materials
Description: Supplementary Figures and Tables.

File name: Supplementary Video 1
Description: Seven-ingredient printed dessert. This video provides a practical demonstration of a multi-ingredient print. We achieve a successful seven-ingredient print using an iterative design approach. Each multi-ingredient design was printed and iterated upon until a structurally stable print was achieved. Here, we illustrate our process and main experimental results.

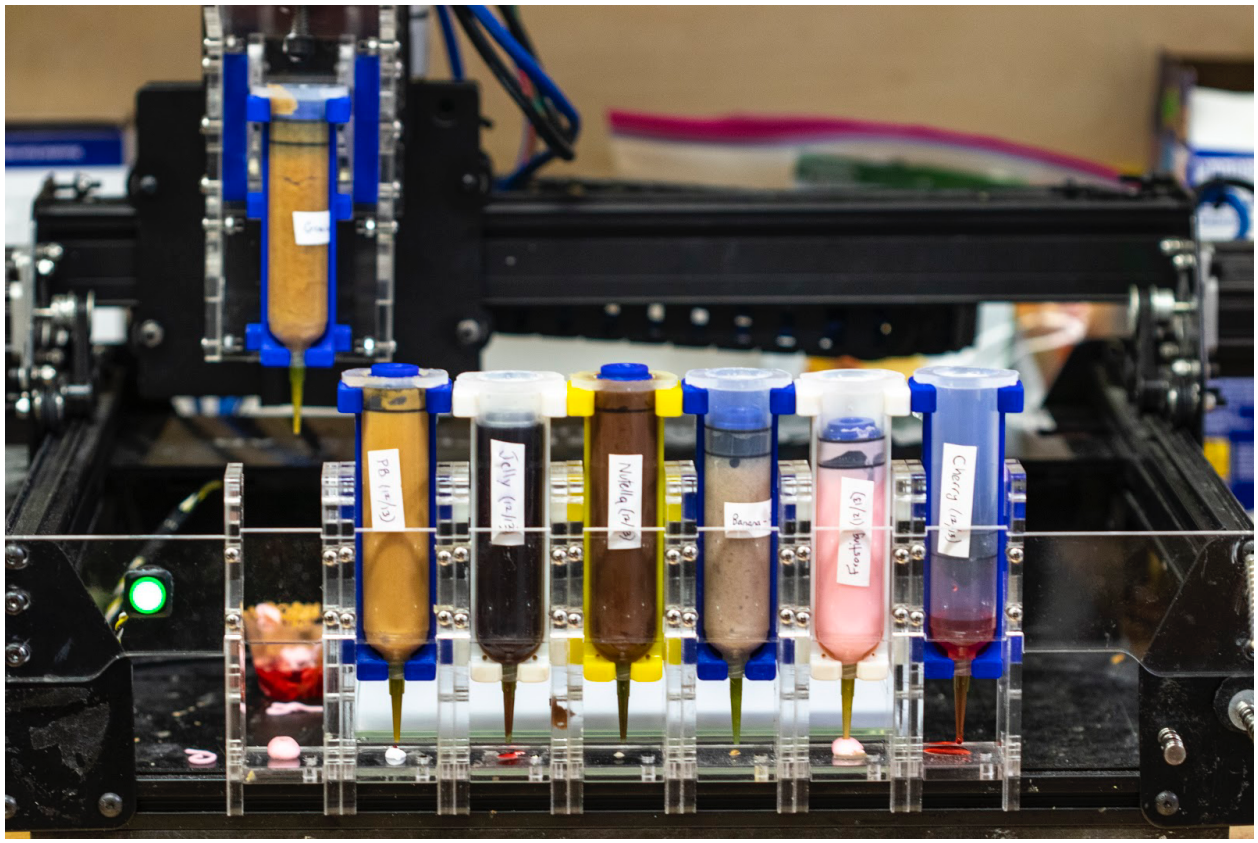
Supplementary Figures



Supplementary Figure 1: *Failed cheesecake prints.* ***a*** *For initial designs, the jam could not hold its shape on a flat layer and needed to be pooled.* ***b*** *With no supporting walls, graham cracker paste crushed softer ingredients below it.* ***c***, ***d*** *Thin walls were prone to crumbling and needed to be tapered.* ***e*** *Adding graham cracker walls better supported the entire structure.* ***f*** *Occasionally, the graham cracker paste would form squiggles due to incorrect z-height or drying of the ingredient.*

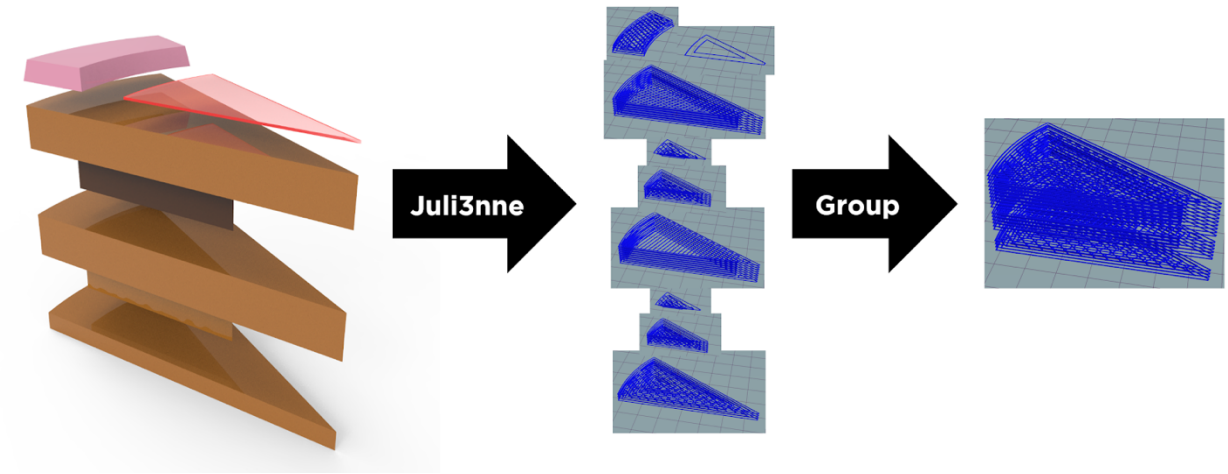


Supplementary Figure 2: *Our customized food printer. The extrusion mechanism and tool carriage were designed and attached to the body of the machine. Printer can accommodate up to seven ingredients.*



Supplementary Figure 3: *Front view of food printer showing seven filled food cartridges. Each cartridge has its own tool post and can be picked and placed by the extrusion mechanism.*

Supplementary Figure 4: *Isometric view of mounted laser (left) and close-up view of blue laser (right).*



Supplementary Figure 5: *Generation of G-code from STL files using Juli3nne. Individual object files are sliced to layers and assembled to provide a single printable file.*

Supplementary Figure 6: *Calibration of peanut butter. The extrusion multiplier is adjusted until the rectilinear infill pattern has no overlapping sections.*

Supplementary Tables

	Horizontal	Vertical
Beam size at aperture (mm)	5.21	5.99
Beam waist position (mm)	0	0
Beam waist size (mm)	5.21	5.99
Beam size at 4 m (mm)	7.77	7.82
Beam size at 14 m (mm)	12.59	22.35
Divergence (mRad)	0.482	1.453

Supplementary Table 1: *Blue diode laser specifications.*

Ingredient	Extrusion multiplier
Graham cracker paste	0.100
Peanut butter	0.050
Cake frosting	0.045
Nutella	0.040
Banana puree	0.030
Strawberry jam	0.030
Cherry drizzle	0.005

Supplementary Table 2: *Extrusion multipliers used for ingredients in the printed cake.*