paragrip

doorhandles by parameter

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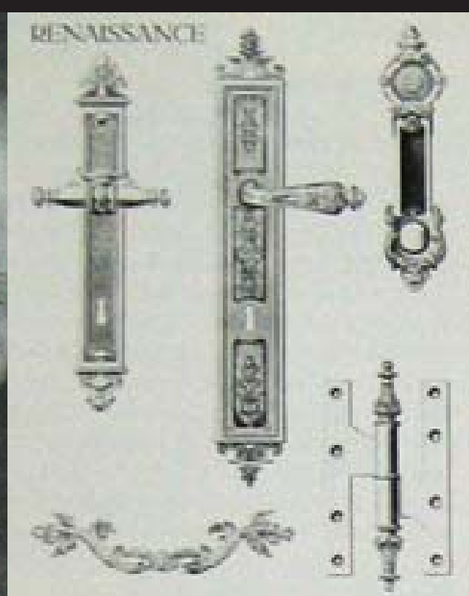
// design approach

/ Doorhandles and grips are the only haptic contact of humans and buildings. As an architectural detail they play an important role in architecural design

/ Doorhandles today rather please the eye than the hand. The „moderne“ reduced haptic and ergonomic qualities to visual statements.

/ No difference in design and haptic experience is made between handles of very different user or functions within an architectural context.

/ Ornament or surface structure is not used as a medium to supply information about function and usage of the room/ building one is entering.



// thesis

The digital chain from design software to cnc production equipment allows the production of individual, mass customized products nearly as fast and cost efficient as standardized products.

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Why not use a software to customize handles to users and usergoups, defining private, public and representative space on the palm of the person gripping the handle?

Why not use the digital chain to design and fabricate doorhandles being able to incorporate design aspects such as haptic quality, ornament and infostructure?

Following parameter groups are set up to design and produce unique doorhandles and grips generated by user defined parameters:

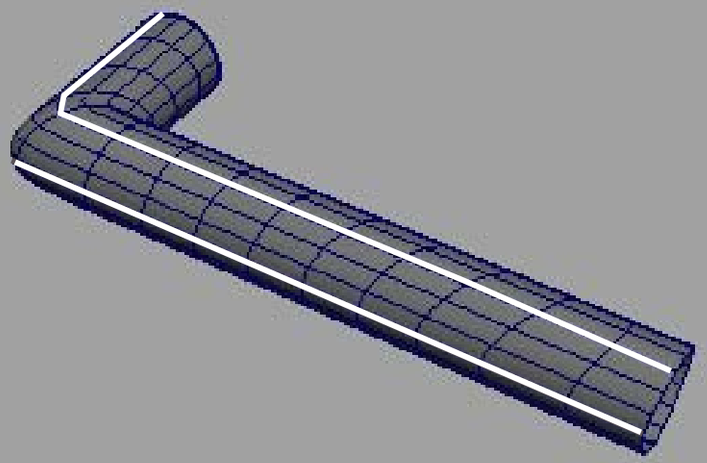
/ group 1_handletype
/ group 2_size and proportion
/ group 3_ergonomics
/ group 4_ornament and surface structure

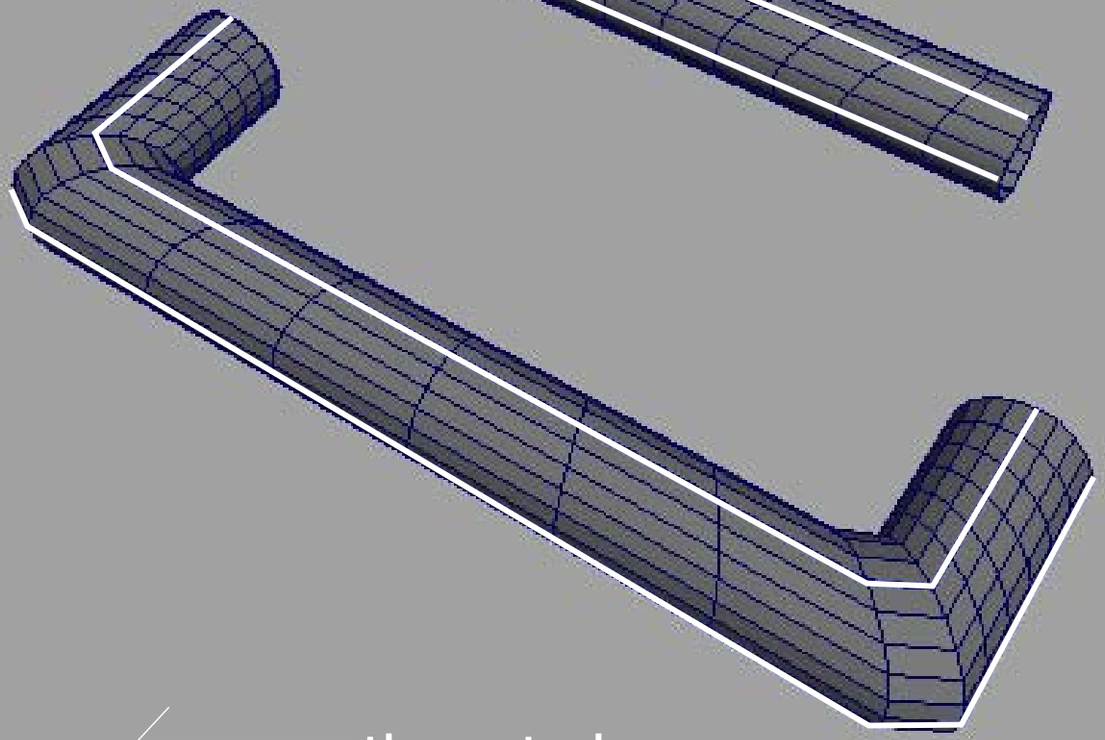
The design process itself is influenced by specific attributes and capabilities of software (MAYA, Surfcam, Gcode) and Hardware (cnc 3-axis mill) to generate and produce complex curved geometry as well as surface ornament and texture.

// group1_handletype

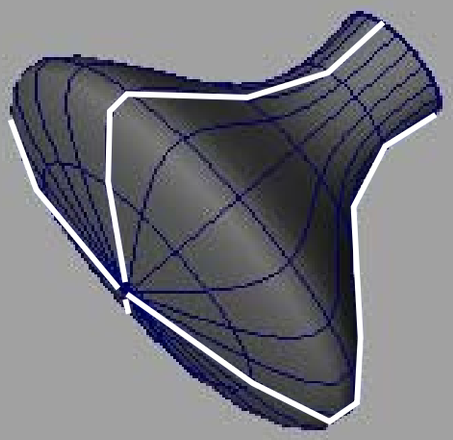
Three different metahandles provide the formal skeleton.
By choosing the type, the user defines the basic architecural context.
Each geometry is created by describing curves which generate a basic surface.

/ the doorhandle
used on inside doors, private as well as official





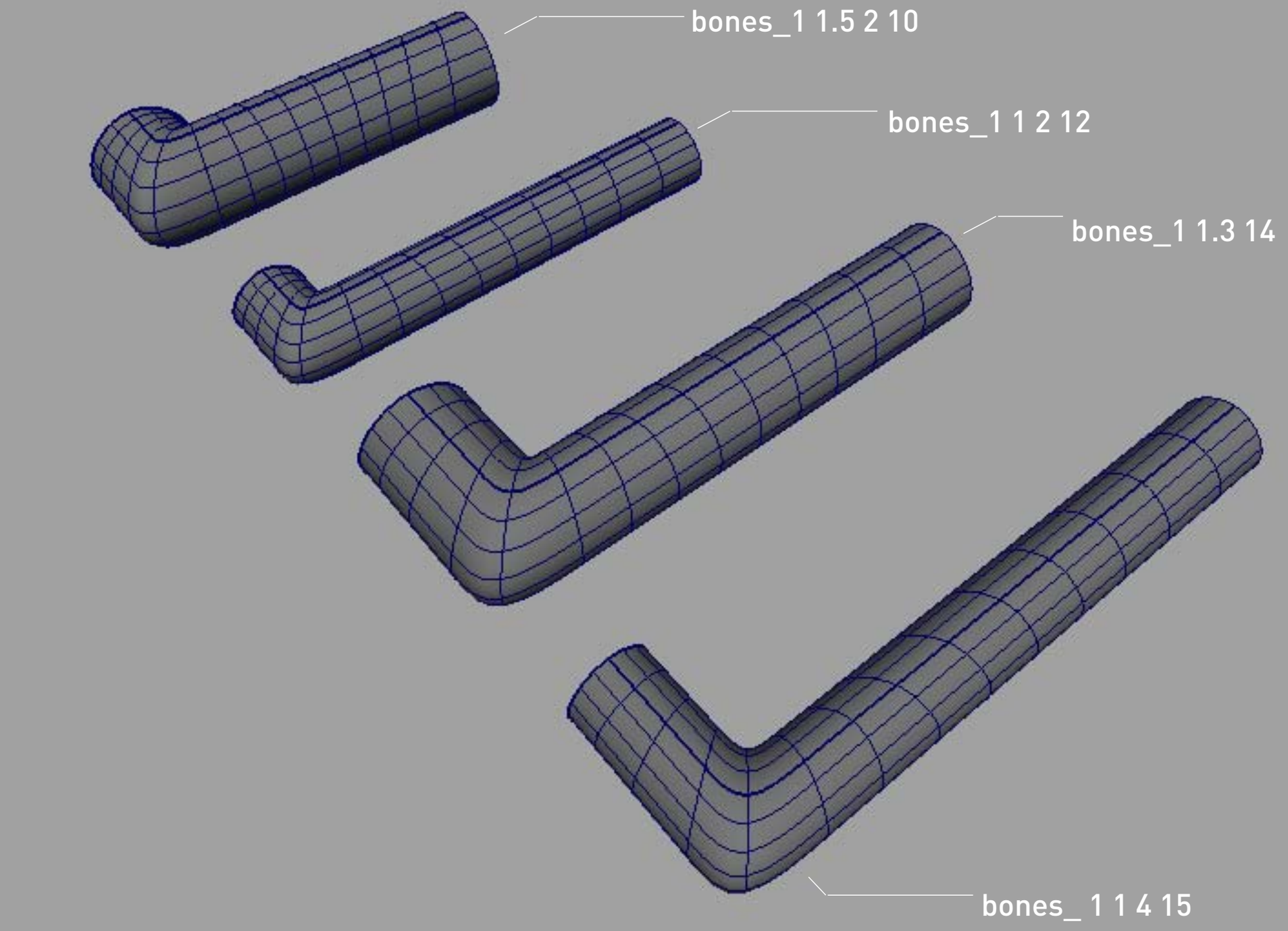
the entrybar
used on entrance situations



the doorknob
used on private doors or windows

// group 2_size and proportion

The creation of the descibing curves incorporates parameters of type, stem and grip radius, stemlength and grip width.

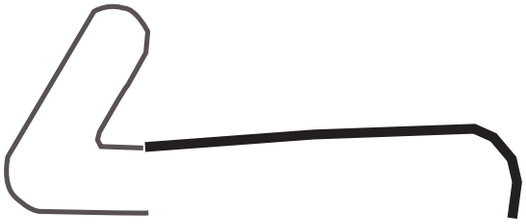


// group 3_ergonomics

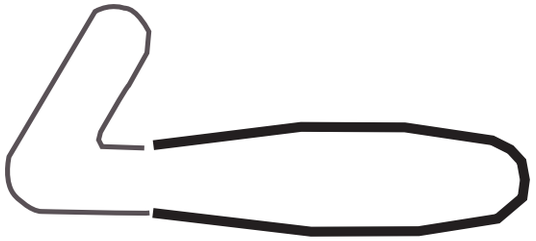
After setting up the skeleton, a third set of paramters customize the handle for a user or usergroups: The " four principles of gripping", set up 1986 by Otl Aicher, describe four locations on the handle where individual ergonomic parameters influence the design:

thumb rest

fingers



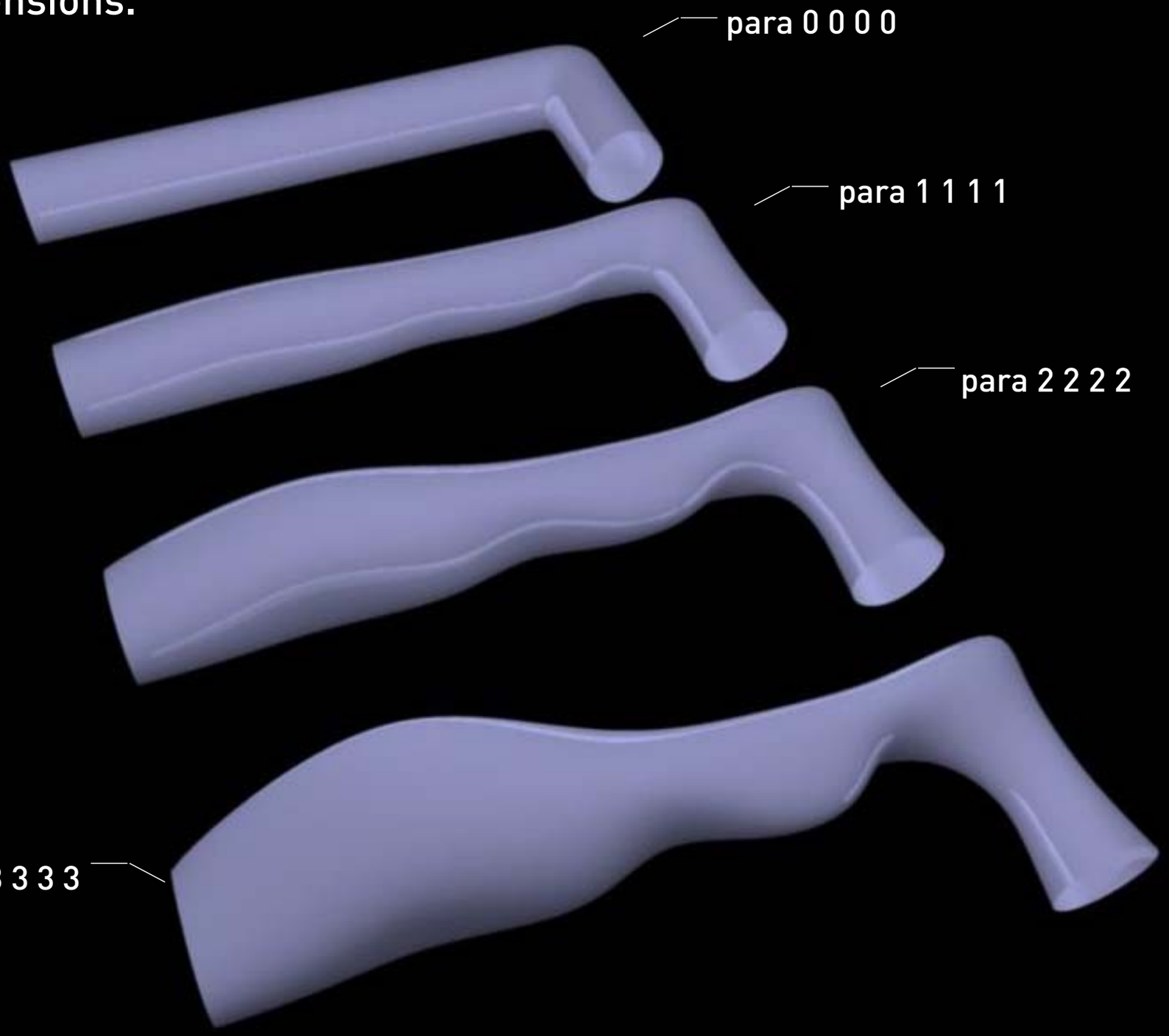
palm rest



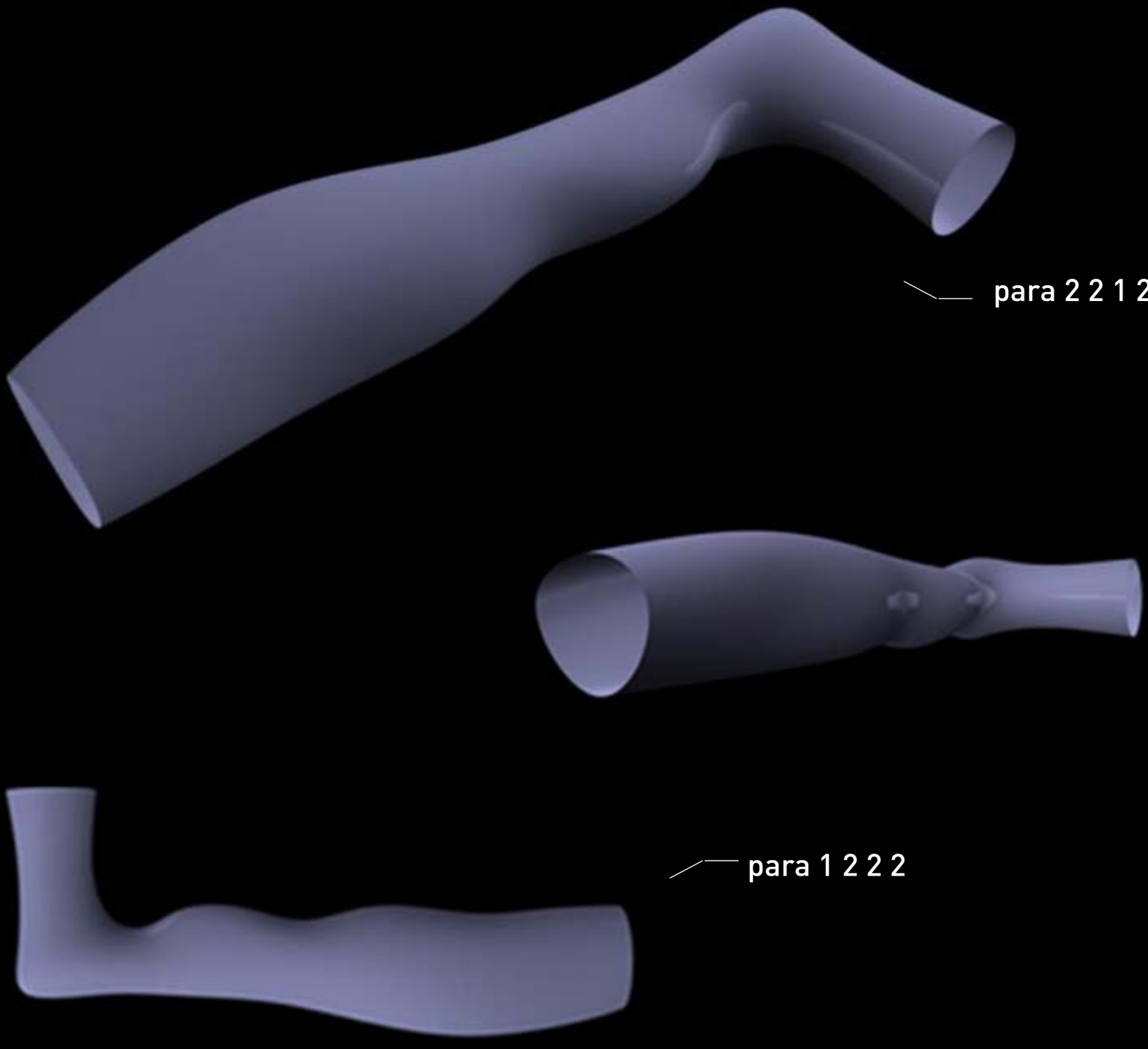
handle volume

/ ergonomics in parameters

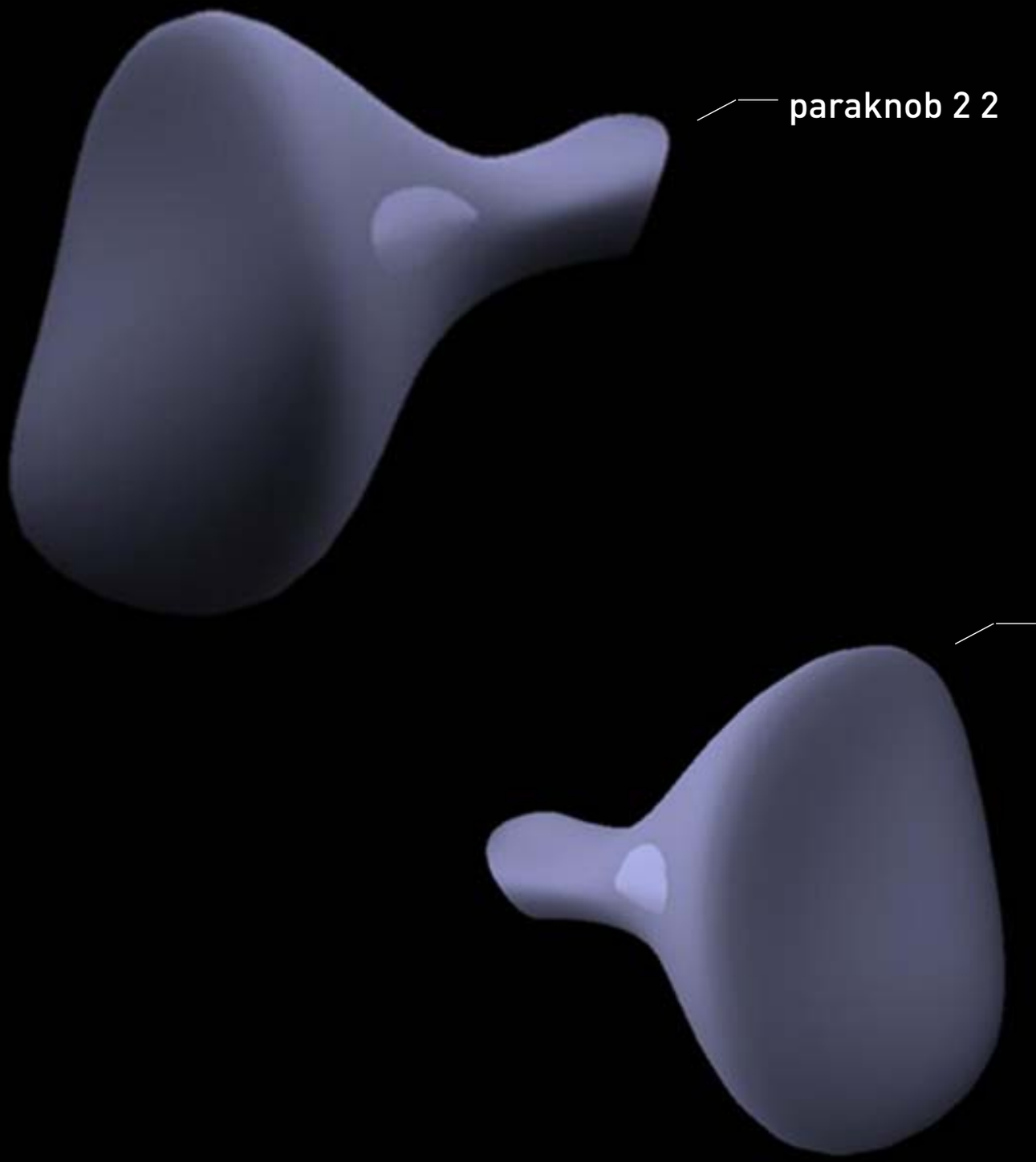
The handles are generated after parameter entry for thumb, finger palm and handle. The skin is deformed through sine and cosine algorythms creating smooth surface curvature in all three dimensions.



/ parameter example type1_handle



/ parameter example type2_knob



// group 4_ornament and surface structure

Doorhandles could be used as supplier of individualy customized information:

_ surface texture and haptic quality describe room usage, e.g. rough pattern shows emergency doors

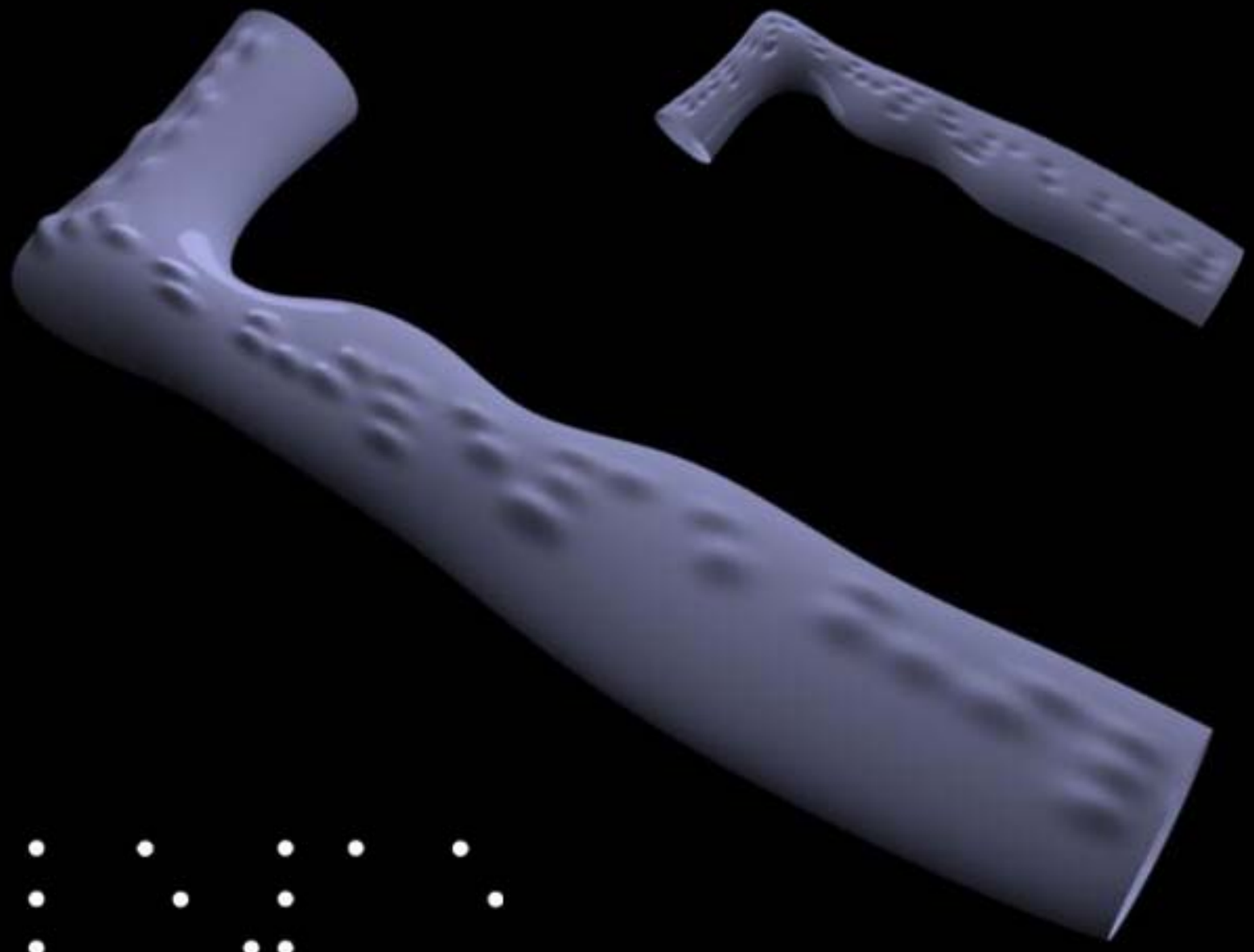
_ ornament underlines important doors within standarized buildings, displays representative functions, e.g. meeting rooms

_ tactile information, e.g. braille letters can help disabled persons to recognize doors and rooms

_ security features or building technology such as fingerprint scan or data transmissions to authorize persons can be individually integrated.

// surface structure example: braille code

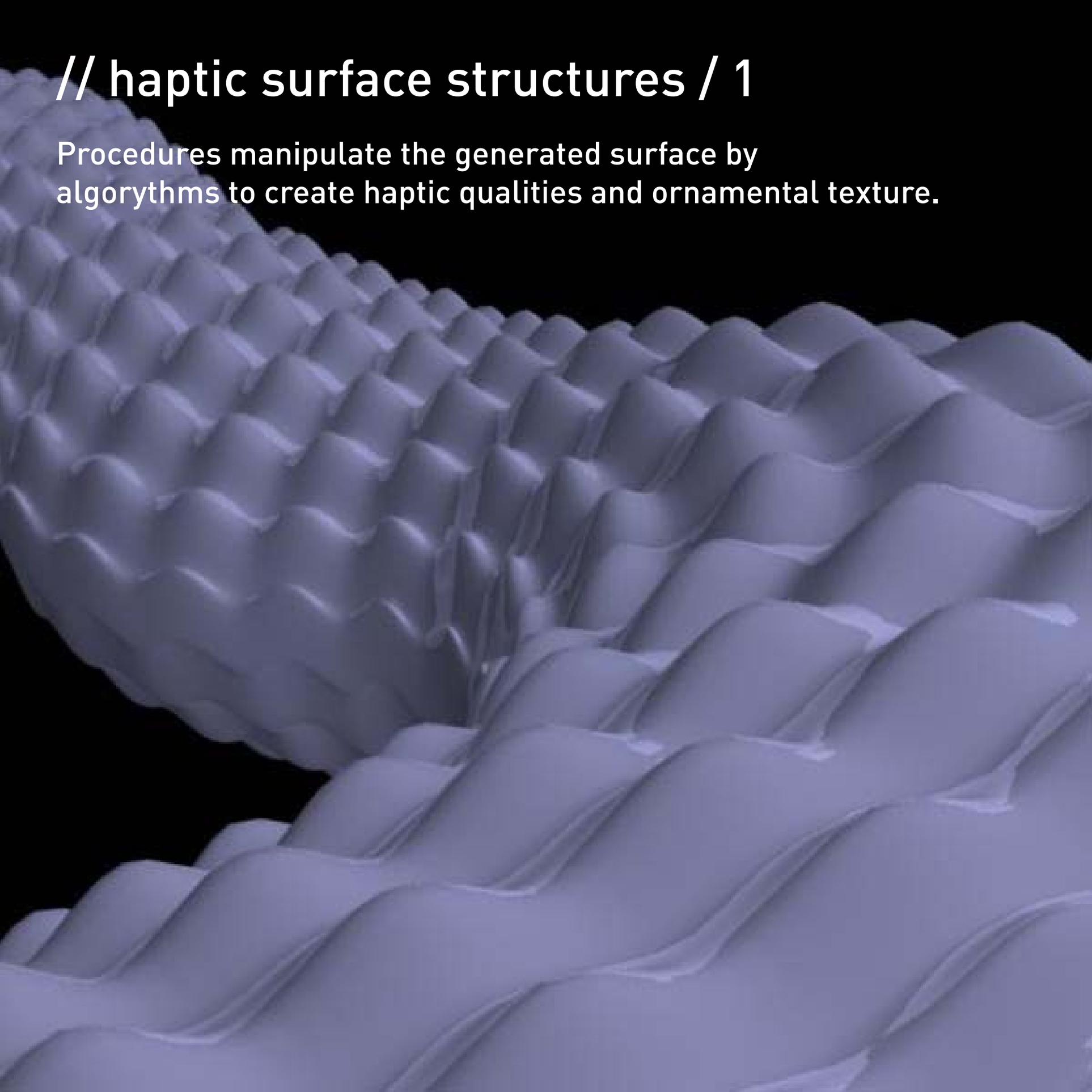
The braille procedure imprints the building and room number onto the generated surface of the pargrip. for later stages, an input interface and automatic translation from arabic letters into braille is provided.



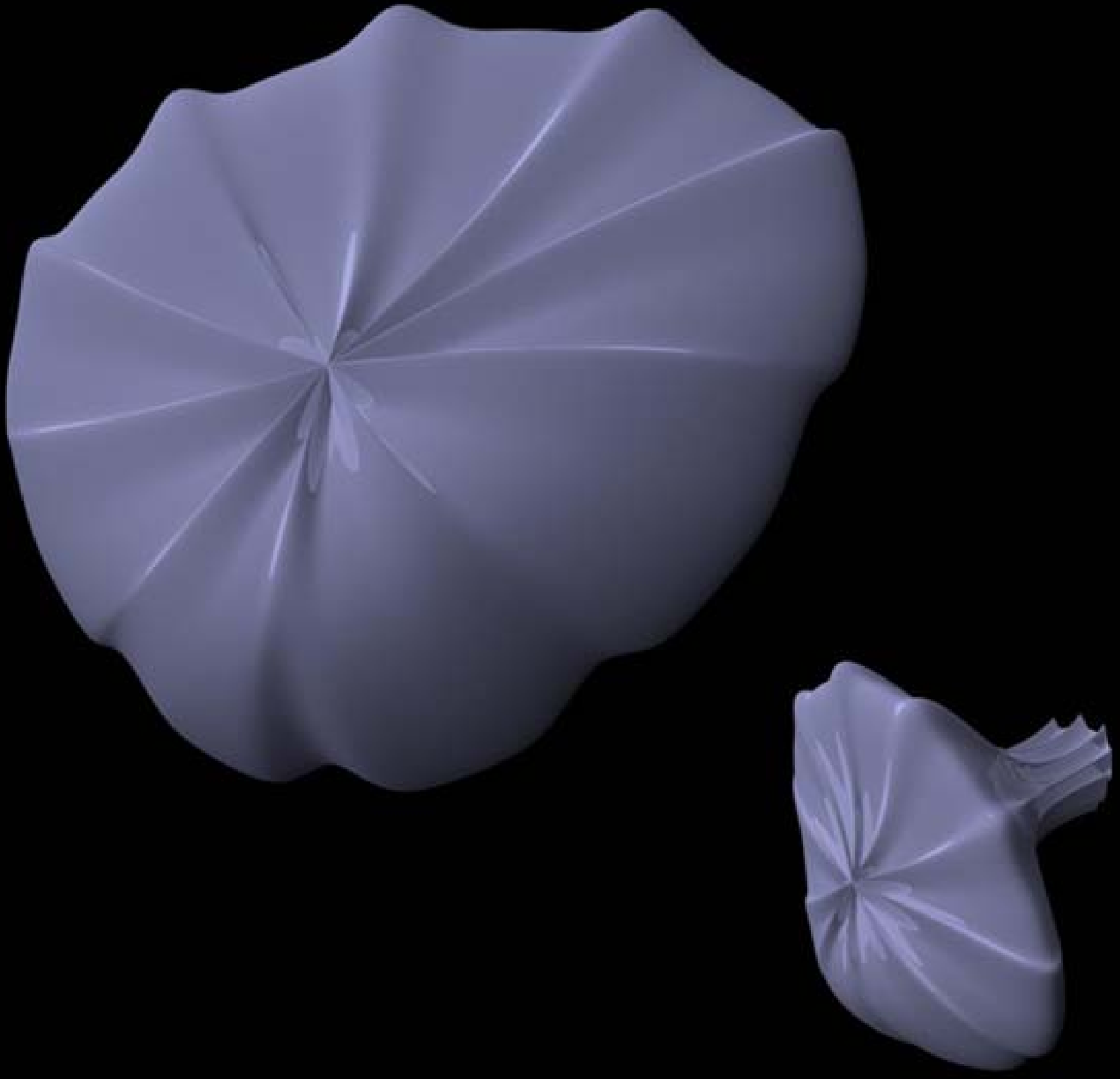
H I L E 1 5

// haptic surface structures / 1

Procedures manipulate the generated surface by algorythms to create haptic qualities and ornamental texture.



// haptic surface structures / 2



// haptic surface structures / 3

// the digital output

400 lines of mel.code

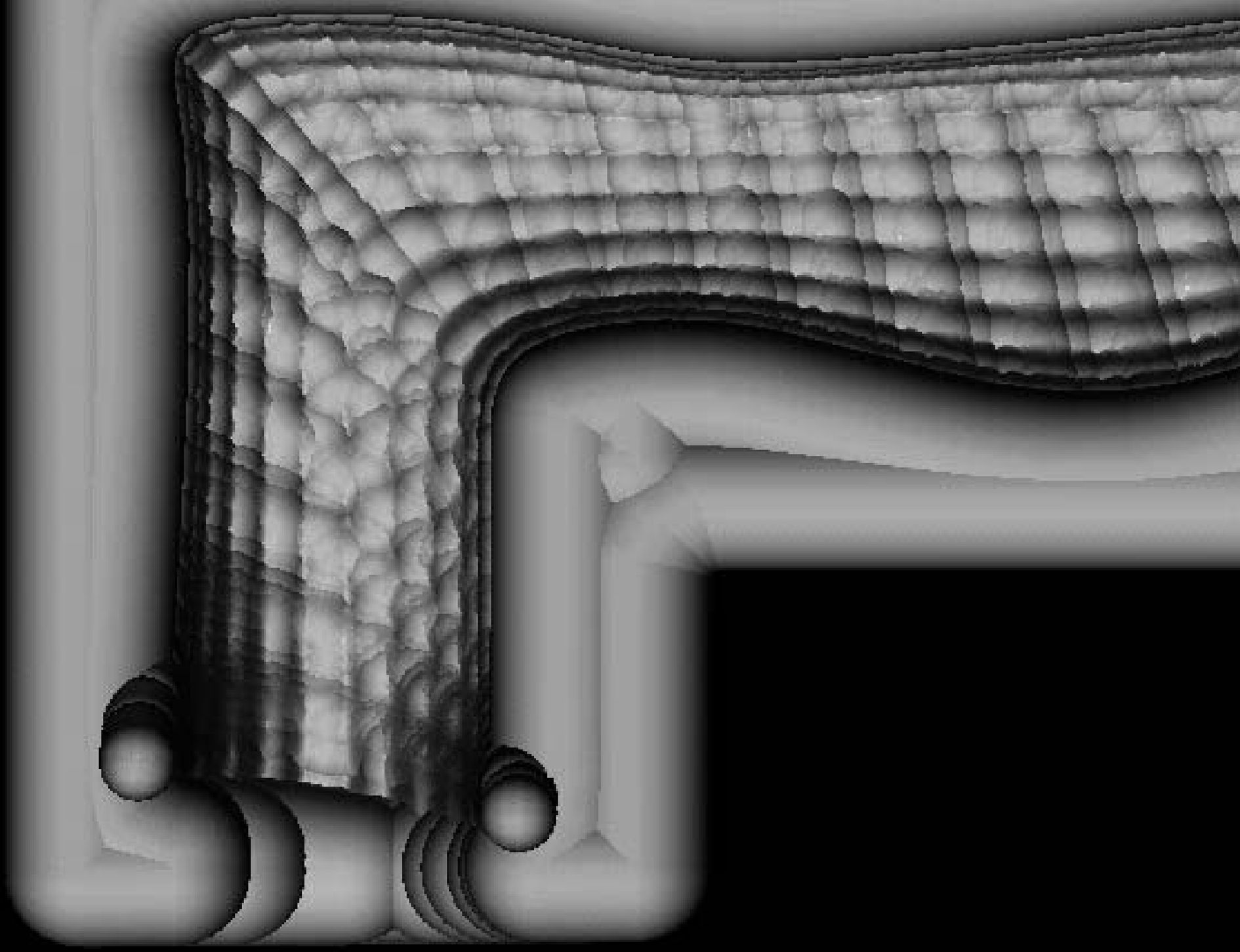
....

// parameters to adjust the surfaces all by sine + cosine function

```
global proc para (float $finger, float $thumb, float $palm, float $curve)
{

// palmrest sine curvature
int $ci;
float $Yval;

for ($ci = 10; $ci ← 16; $ci++)
{
        $Yval = (cos(deg_to_rad ($ci*$ci)*-1.1)*($palm*0.4));
        select curve_right.cv[$ci];
        move -r 0 (-$Yval) ($Yval*($Yval));
}

        for ($ci = 6; $ci ← 9; $ci++)
{
        $Yval = (cos(deg_to_rad ($ci*$ci)*1.2)*($palm*0.2));
        select curve_right.cv[$ci];
        move -r 0 (-$Yval) ($Yval*($Yval));
}



// fingers sine curvature
int $fi;
float $Fval;

for ($fi = 0; $fi ← 14; $fi++)
{
        $Fval = (sin(deg_to_rad ($fi*$fi)*6.2)*($finger*0.2));
        select curve_left.cv[$fi
        move -r 0 ((-$Fval)) 0 ;
}

        for ($fi = 1; $fi ← 5; $fi++)
{
        $Fval = (sin(deg_to_rad ($fi*$fi)*8)*($finger*0.2));
        select curve_left.cv[$fi];
        move -r ($Fval*0.5) ($Fval) 0 ;
}

.....
```

// production process / 1

After generating the handle, the geometry is prepared for the milling on a 3-axis cnc machine. with the surfcam software toolpaths are set to define surface quality and appearcance.



// production process / 2

The cnc 3-axis mill follows set toolpaths translated into g-code. Hopefully.

// production process / 4

Side one after the roughcut.

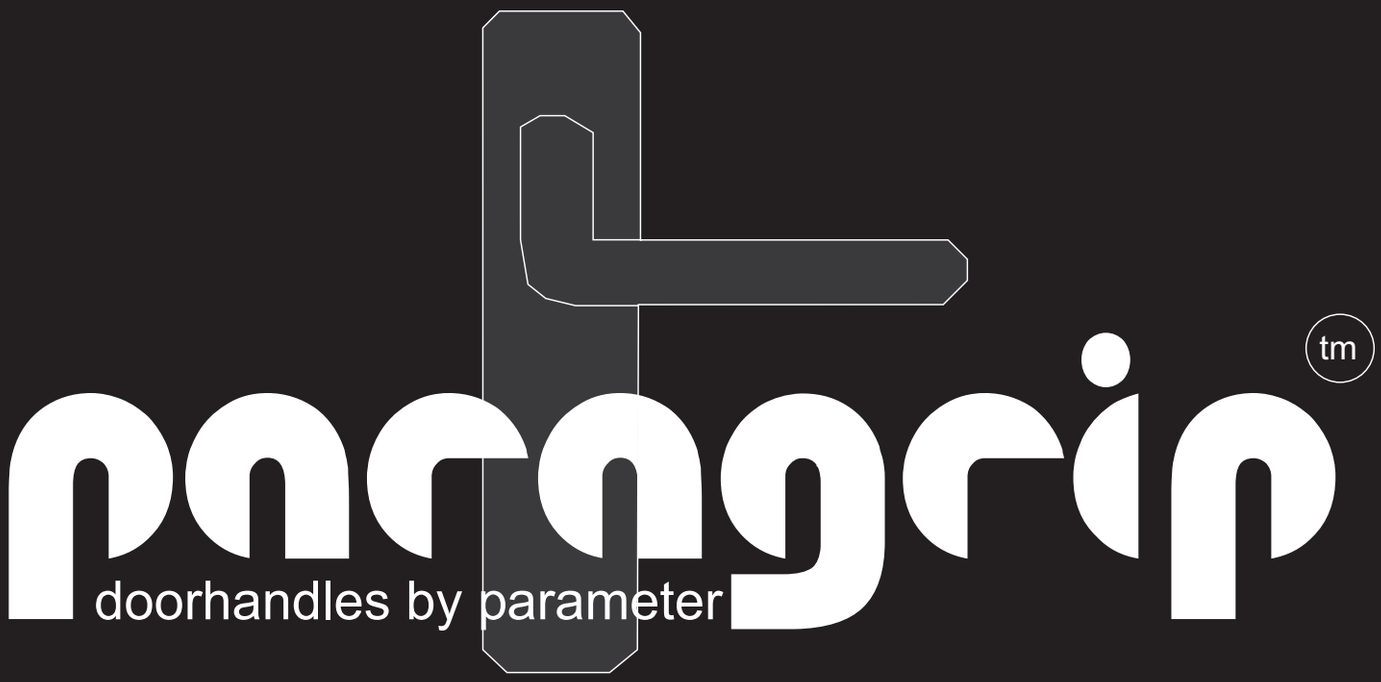
// production process / 5

2 handles and 3 knobs out of one block..

// digital to real - the handle / 1

// digital to real - the handle / 2

// digital to real - the handle / 2



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