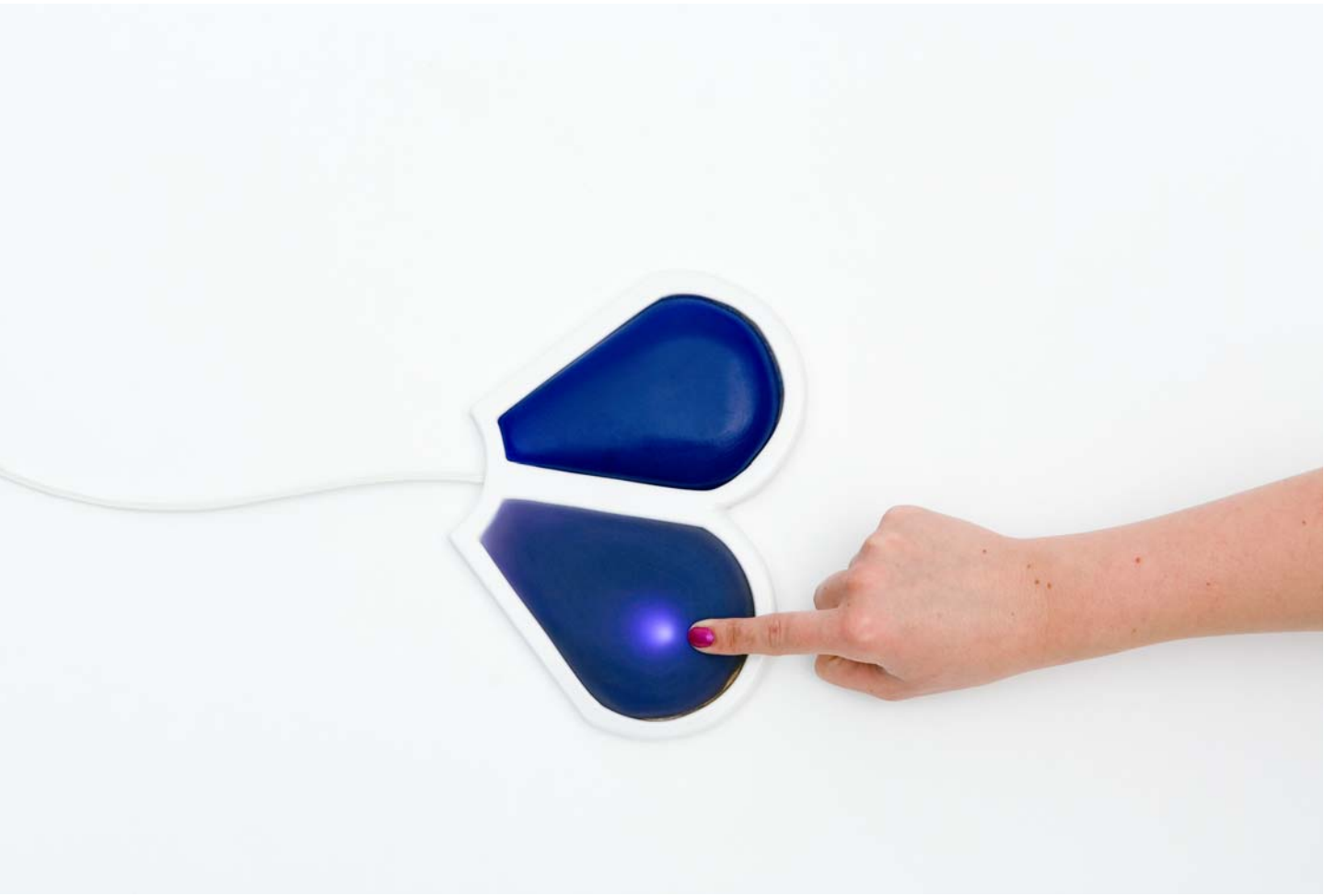

Andrew
Marsh
Portfolio
09


Project 1
Synflower

"Traditional instruments are hard to play. It takes a long time to acquire physical skills which aren't necessarily the essential qualities of making music. It takes years just to get a good tone quality on a violin or to play a tune. If we could find a way to allow people to spend the same amount of concentration and effort on listening and thinking and evaluating the difference between things and about how to communicate musical ideas to somebody else, how to make music with somebody else, it would be a great advantage. Not only would the general level of musical creativity go up, but you'd have a much more aware, educated, sensitive, listening and participatory public."

Tod Machover

Synflower

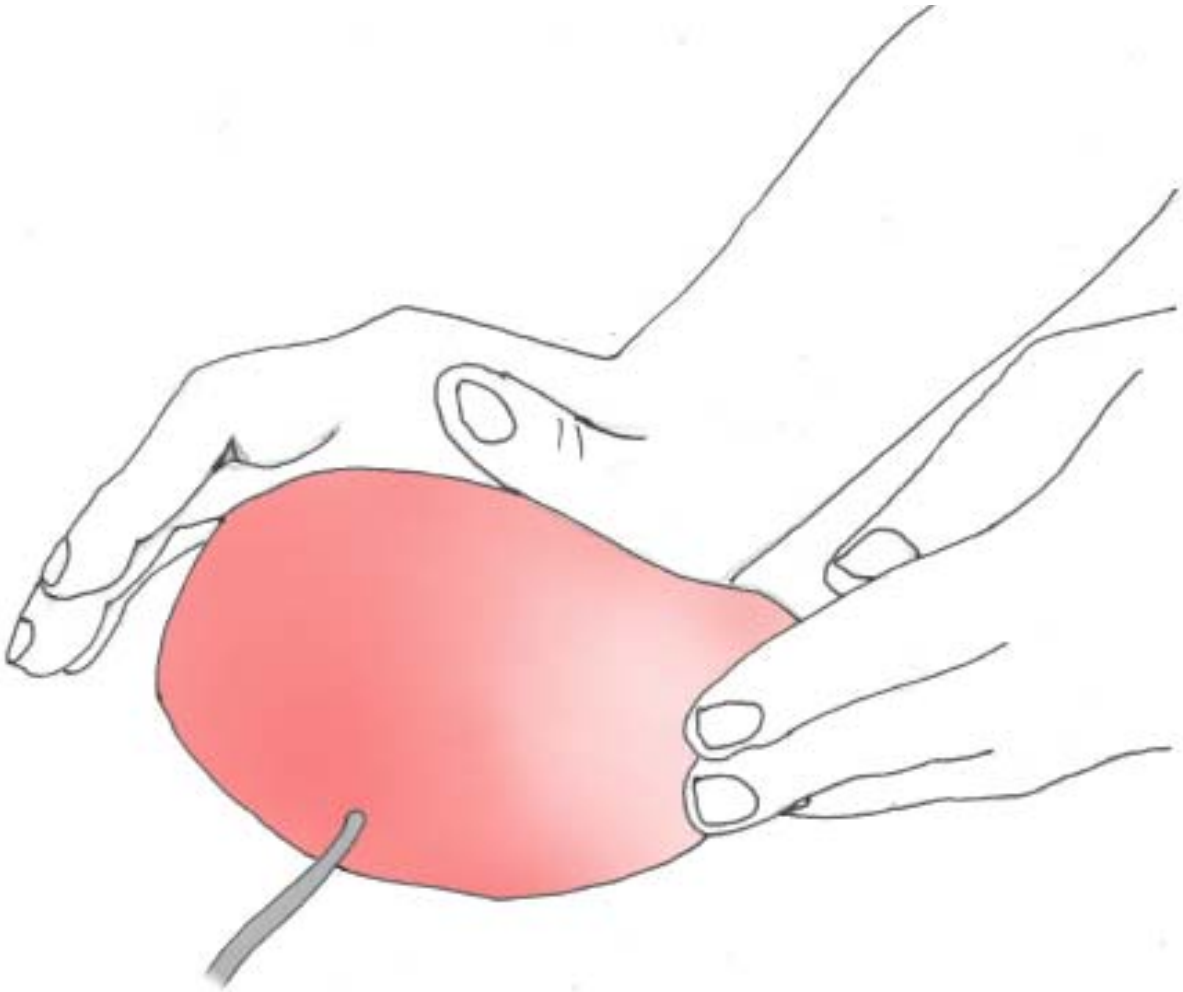


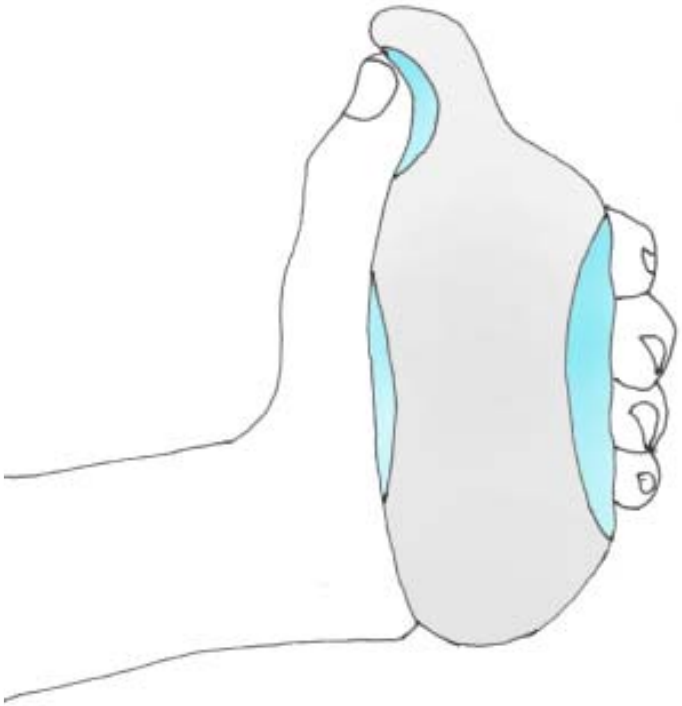
The Synflower is a multi-player musical instrument for 1 to 8 people. It concentrates on the social and creative aspects of music creation, and is designed to get people to engage with each other within the context of a musical experience.

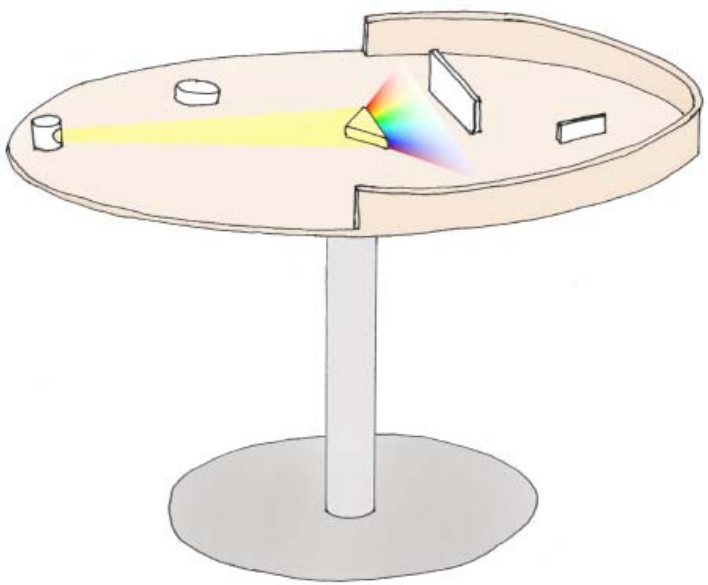
For this reason, it was important for the instrument to be as intuitive as possible, to allow users of different skill levels to play together without intimidation.

The project was inspired largely by techniques used in music therapy and also draws on psychological and sociological theories in order to make the experience of playing more expressive, creative, social and ultimately enjoyable.

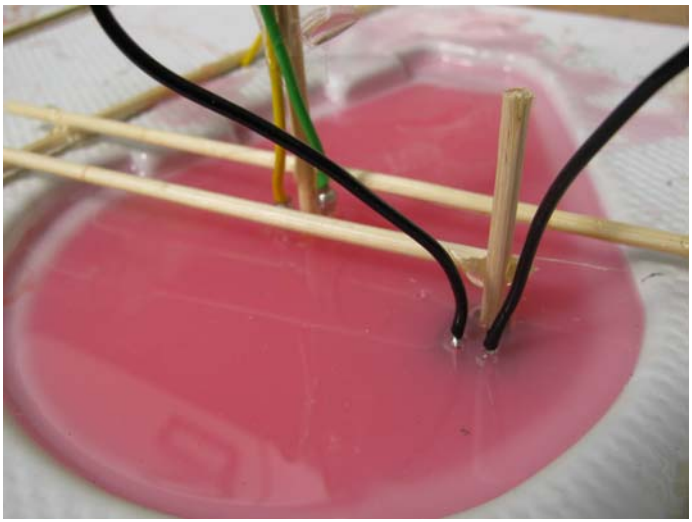
Initial Concepts





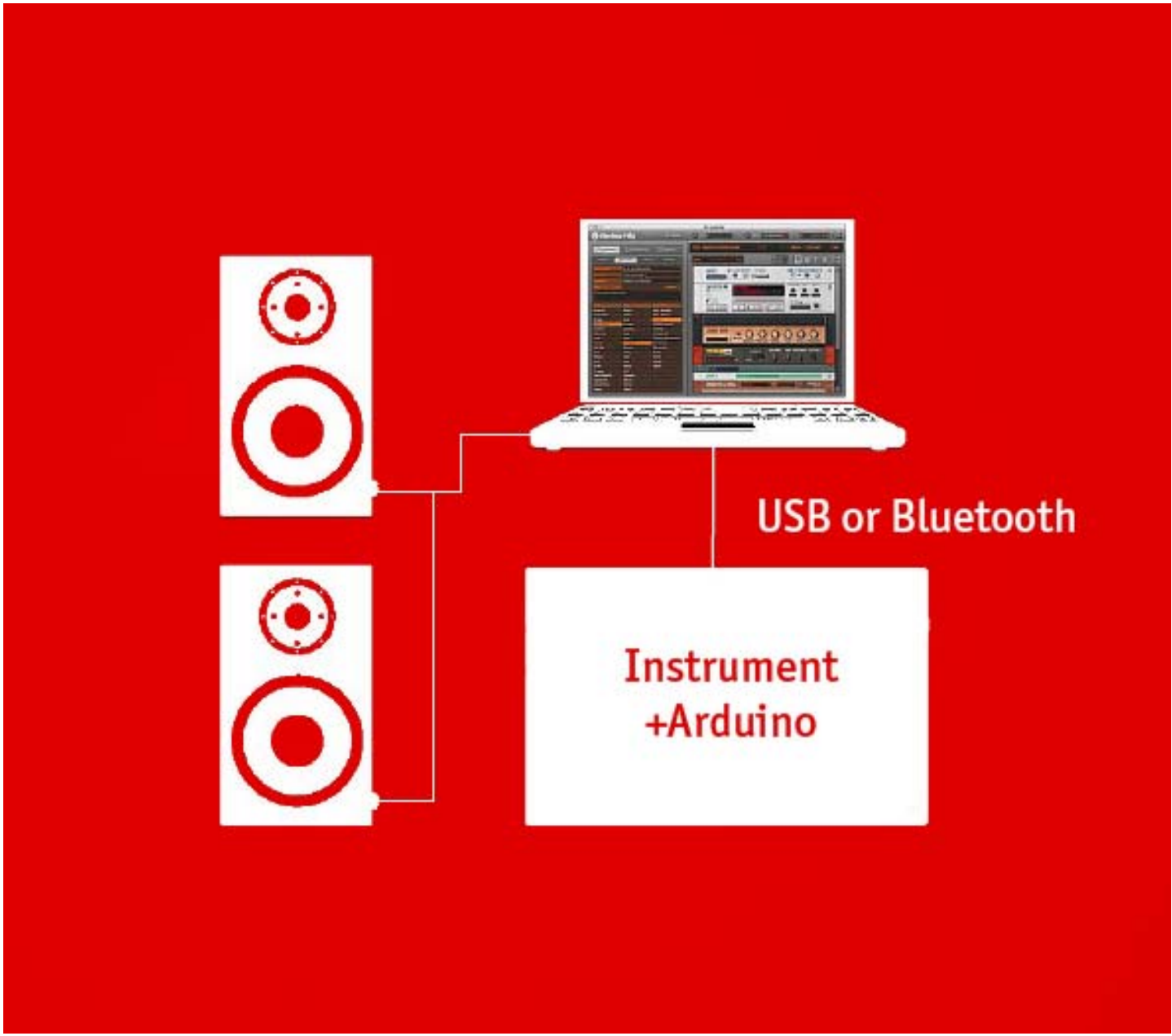


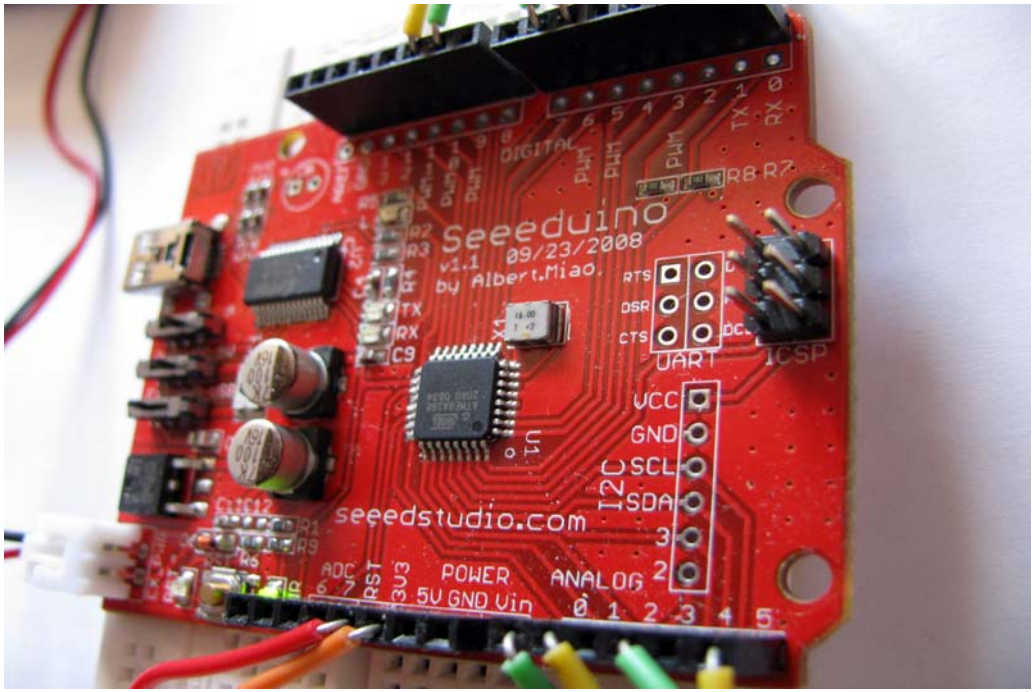
Development



Each Pressure pad is moulded from soft silicone with a LED and a tactile switch imbedded. A force sensor is positioned underneath.

Colours were mixed from red, yellow and blue polyester pigments. It was important to keep the pads translucent so that light from the LED could be seen.


USB or Bluetooth
Instrument
+Arduino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by Albert.Miao
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DIGITAL
PWM
TX
RX
R8 R7
R2
R3
TX
RX
C9
RTS
DSR
CTS
UART
ICSP
VCC
GND
SCL
SDA
I2C
3
2
U1
C1
C12
R1
R5
R6
ADC
6 7
RST
3V3
POWER
5V GND Vin
ANALOG
0 1 2 3 4 5

Project 2

Surgical Alignment

"Devise a system to improve the accuracy of alignment in either knee or hip replacement surgery making use of laser technology"

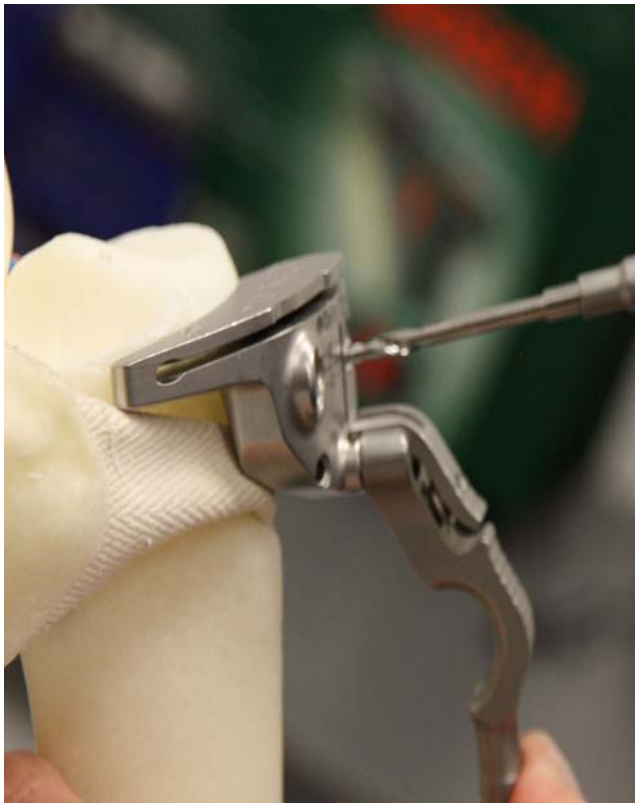
Research

The longevity of both hip and knee implants is greatly affected by the accuracy with which they are inserted during surgery.

One of the problems with the procedure is the craft based approach, making alignment more of an art than a science.

The current system takes a long time to set up during surgery and is also invasive to the patient, lengthening recovery.

Even after this, the tools used to insert the implants can ruin much of the precision achieved due to vibrations and instability.



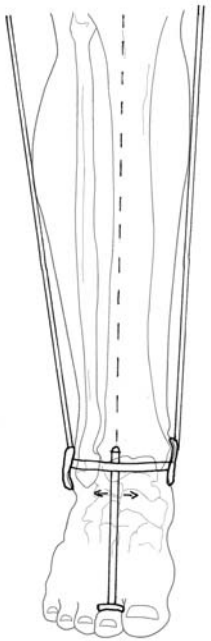
As well as these primary directives, there were various other constraints and considerations.

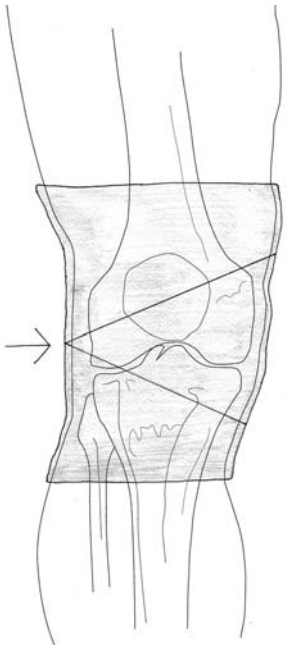
It was discovered that surgeons do not check alignment as often as recommended because of the extra time it takes. Encouraging more regular checking would help improve accuracy.

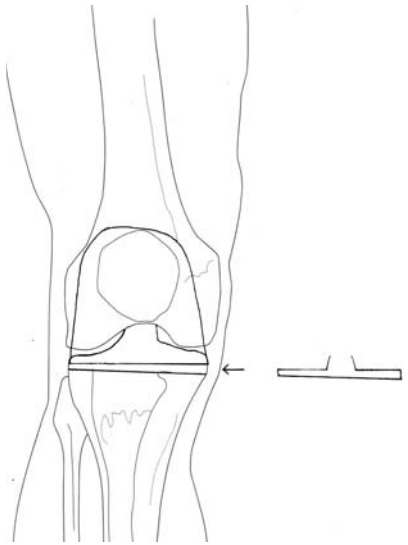
Due to the stressful nature of the surgical environment the solution needed to be intuitive and simple, both functionally and visually.

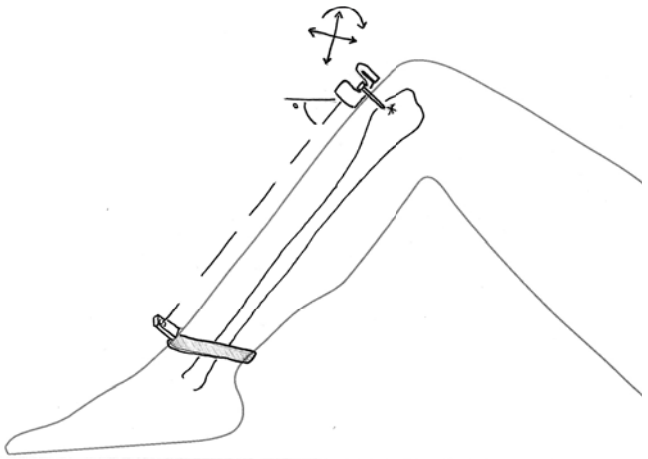
Any outcomes needed to be able to withstand the surgical environment and high temperature, high pressure sterilisation.

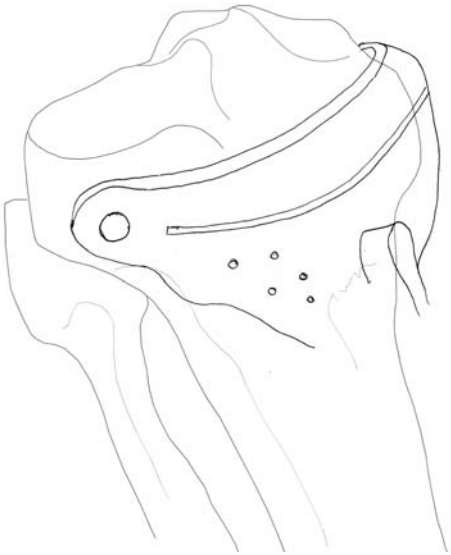
Initial Concepts



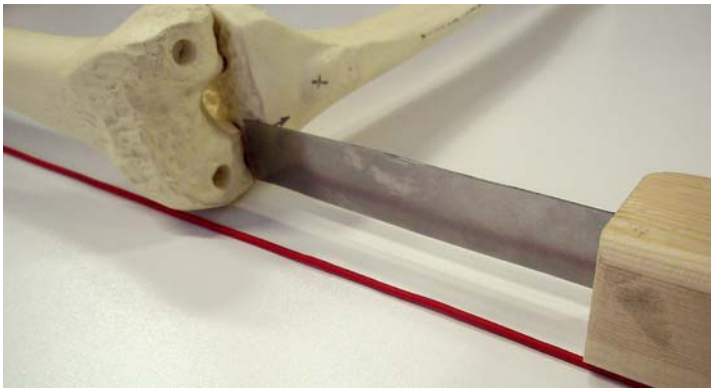








Development



Outcomes

Laser aligned cutting block

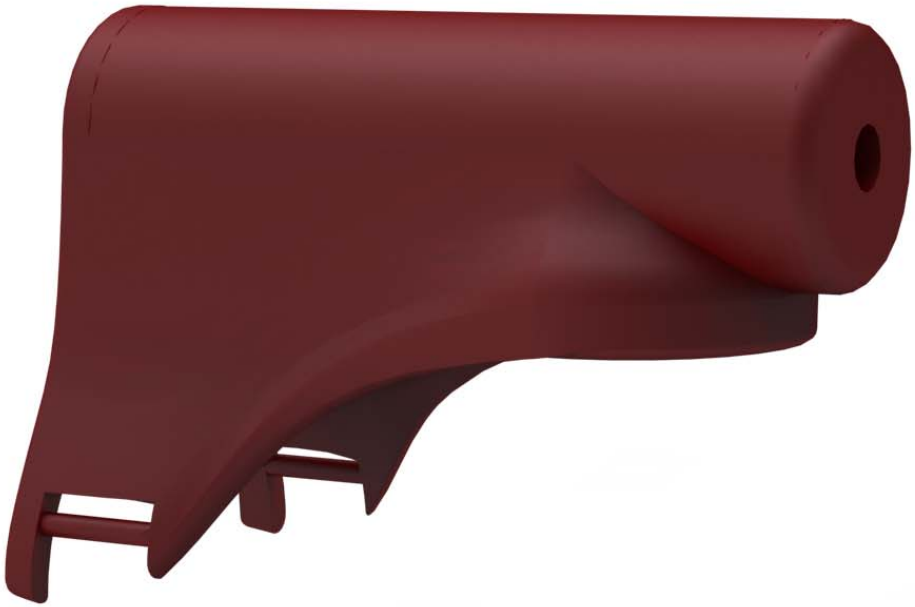
The device reverses the current alignment procedure, fixing first and aligning second. This allows much finer adjustments.

> Lower possibility of human error
> Higher accuracy
> No time increase
> Intuitive

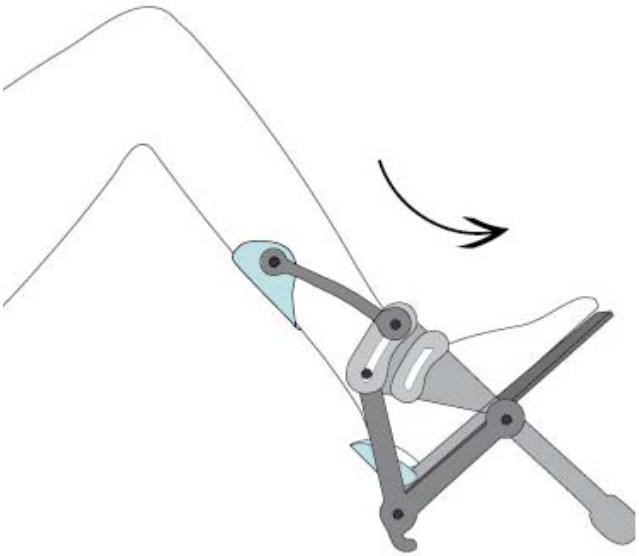
Saw mounted laser guide

Mounted on existing bone saw designs, the device uses a plane of laser light to alert the surgeon to blade bending or twisting.

> Higher accuracy
> Simple
> Low cost
> Constant feedback



Cutting block procedure

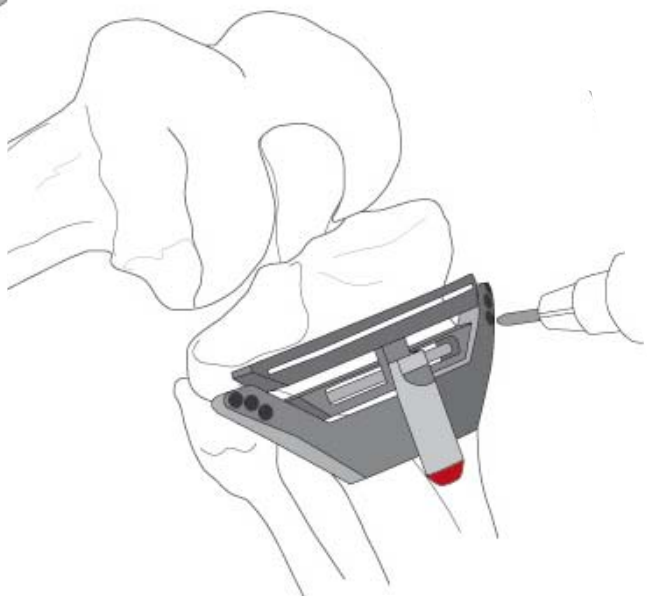


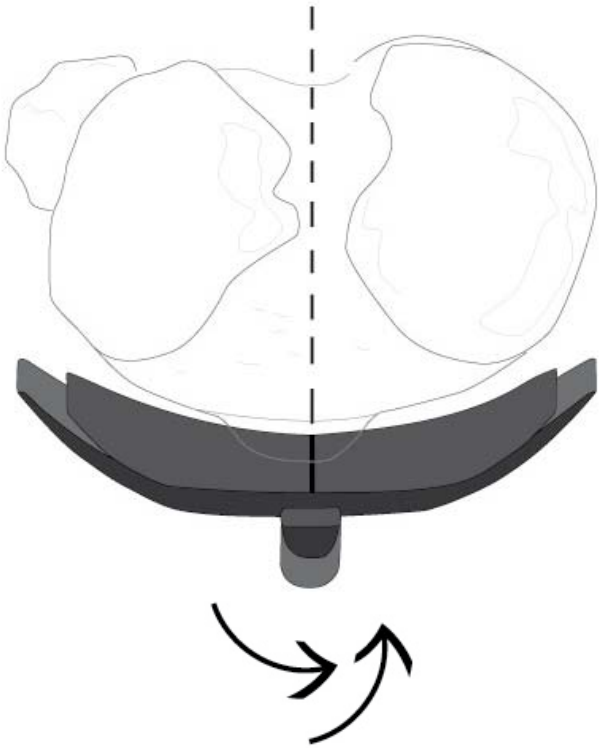
Step 1

Place foot in Jig.

Step 2

Place the block by approximation.
Fasten with pins.



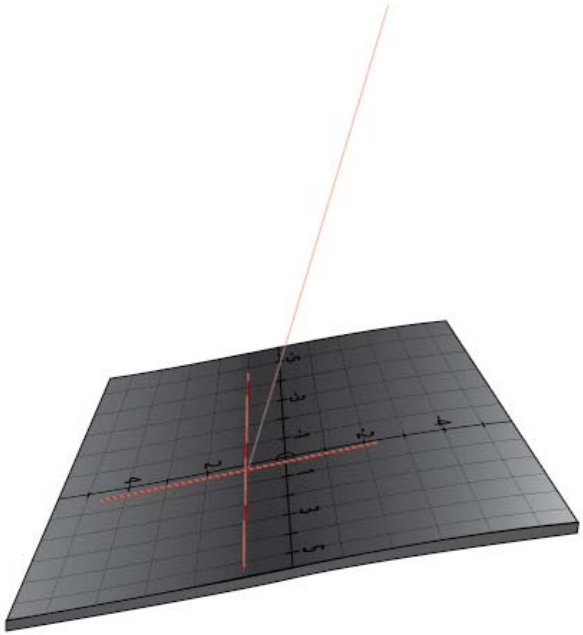


Step 3

Use the guide for alignment of sideways positioning.

Step 4

Use the laser guide to adjust tilt and swing, then lock into place. Varus/vulgus variations can be compensated for with the swing adjustment.

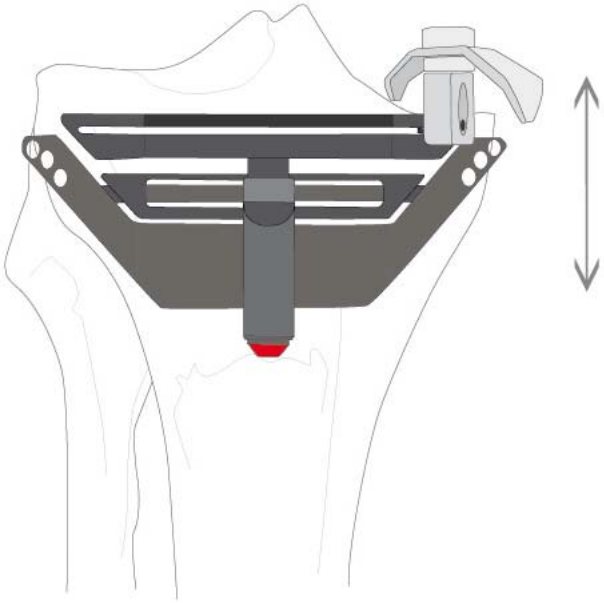


Step 5

The receiver gives visual guidance for misalignment.

Step 6

Place foot in Jig. Adjust the height of the cutting line using the stylus.

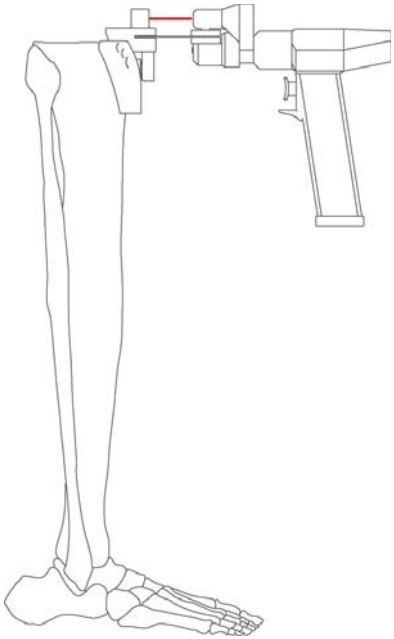



DePuy

Saw Laser

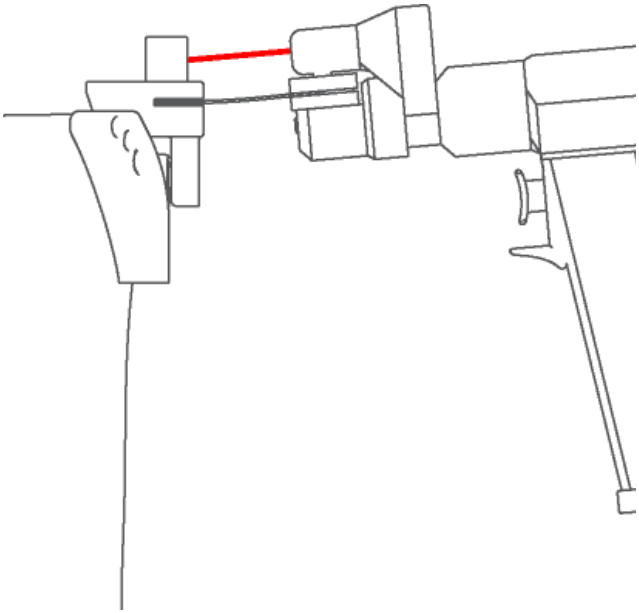
Strain Gauges

The use of strain gauges could greatly improve the accuracy of the system. In theory, if gauges were aligned as above, they could be used to detect only longitudinal strain. This can be used to calculate the bending of the blade, and visual feedback can be given to the surgeon.



Aligned

Gives the surgeon confidence in the cut.



Misaligned

The information allows the surgeon to rectify the problem before it becomes serious