CHESS PIECE MANUFACTURING TECHNIQUE COMPARISON

MAE364: Gate 4

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Introduction

Our team aims to manufacture a hat themed chess set for use in the New York City municipal building. Here we outline the benefits and disadvantages of alternative traditional manufacturing methods. We will compare this to our additive manufacturing method.

Traditional Methods

Turning

- Good surface finish, low energy process.
- Requires symmetrical geometry.

Milling

- High geometric tolerance with relatively high speed.
- High cost, poor surface finish in radial geometries.

Injection Molding

- Low cost and high speed process.
- Limited geometrical complexity & variance.

Lost Wax Casting

- High surface finish and geometry complexity possible.
- Large amount of steps – increased production time

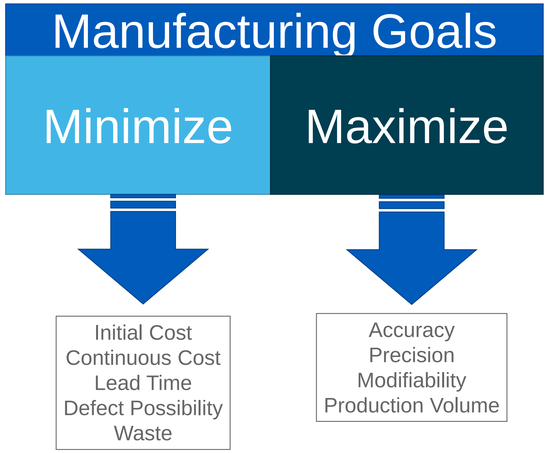
Additive Method

STL Printing

- Low cost & lead times for single units.
- Large range of geometries possible.
- Not optimal for high volume output.

Considered Factors

Comparison of traditional manufacturing methods was based on the optimization of factors shown in the figure below. In each manufacturing case, we determined the importance of each factor, which is the basis for our chosen methods of manufacturing.



Manufacturing Cases

Mass Production

- Full scale production, high volume, low error tolerance.

Prototyping

- Early stage production, design stage.

Low Quantity, High Quality

- Mid-stage production, low volume, lowest error tolerance,

Unique Part Production

- Production focused on creating unique geometries.

The importance of each factor in the cases shown is organized in the decision matrix below.

	Cost	Lead Time	Production Volume	Accuracy	Waste	Modularity
Mass Production	3	3	3	2	3	1
Prototyping	2	3	1	2	1	3
Low Quantity, High Quality	2	1	1	3	1	1
Unique Part Production	2	1	1	3	2	3

3-Critical importance 2- Normal Importance 1- Low Importance

Traditional Method Comparison Results

Comparison to Additive Manufacturing

In order to compare the results of the previous section to our chosen method of STL printing, must consider which case is most similar to ours.

As students working on a new design, we are focused on prototype creation, with an emphasis on low cost and low lead time.

The results show milling is the most feasible alternative to STL printing in our case. The lead times of milling are favorable and the access to a machine shop is available. However, the complex circular geometries could poise surface finish problems in finished products.

STL printing continues to be the best for our situation. It has the quickest lead time out of all the methods and is the cheapest option. The geometries of our chess pieces would not be a challenge for a common STL printer.

Conclusion

Analysis shows that there are a variety of cases where traditional manufacturing methods are optimal. The final conclusion is that additive manufacturing is the most beneficial in our specific situation.

Our research report displays the range of situations in which we could employ traditional methods to create our chess designs. We conducted an in-depth review of each traditional method that led us to our final conclusion.

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