DESIGN PROJECT #1
Cardboard Furniture Design
Introduction to Engineering Design
EDGSN 100 Section 003

Group 4
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Abstract (Executive Summary)

Furniture has become extremely expensive in recent years. The goal of this design is to minimize the cost of furniture while still making it ideal for the college student. This cardboard chair is eco-friendly, sturdy, stylish, storage capable, and ideal for any college dorm room.

1.0 Introduction

Over the years furniture has been created from material such as leather, metal, and fabrics that generally are not recyclable. Most luxury chairs are a great in both size and density. With this size and density comes a greater destruction of the environment. Designed cardboard furniture is completely eco-friendly and is also cost effective. Our design team decided to build a cardboard chair. The cardboard chair was initially created, but then was adjusted many times in order to develop better aesthetics. Since the idea of the chair was created by our design team, no patents could be found that directly represents our design. In this report you will find our mission statement, customer needs analysis, external research, target specification, concept generation, concept selection, final specification, final design, and references.

2.0 Mission Statement

The goal of this design is to build an appealing yet environmentally conscious piece of furniture that is pertinent to the college dorm setting.

3.0 Customer Needs Analysis

Customer needs were gathered through both interviews and a focus group. Each group member conducted four separate interviews for customer needs and the entire design team conducted a focus group with one of the other design teams from our class.

Table 1 Customer Importance Table

No.		Need	Imp.
1	Cardboard chair	Provides a sturdy back support	4
2	Cardboard chair	Must be cheap	3
3	Cardboard chair	Is compactable	5
4	Cardboard chair	Is soft	3
5	Cardboard chair	Has cup-holders	1
6	Cardboard chair	Looks good	5
7	Cardboard chair	Is Stable	4
8	Cardboard chair	Is lightweight	2
9	Cardboard chair	Can recline	2
10	Cardboard chair	Easily assembled	5
11	Cardboard chair	Customizable	4

4.0 External Research

The design team preformed some external research on the strength of cardboard, various chair designs, and we searched the various patents that are related to our product.

4.1 Literature Search

Cardboard furniture is ideal for anyone with a small budget, anyone that's likes to frequently rearrange furniture, or anyone that likes to help the environment. Cardboard furniture is much more transportable than conventional furniture because it is generally collapsible. Since it is collapsible, the transportation of cardboard furniture could potentially save hundreds of dollars. Transporting conventional furniture requires the rental of moving equipment, often multiple people, and the cost of packaging to prevent damage while moving. Cardboard furniture is also readily customizable, so it is perfect for anyone who likes to design their own products. Cardboard furniture can be used a poster-board, the base for a collage of photographs, and a way to save space (Cardboardfurniturestore.com). Cardboard furniture can be considered architectural genius. The furniture designs are endless and some of them are even displayed publicly. There are even many companies that produce cardboard furniture for business because it is so effective (treehugger.com). Cardboard furniture designs are also a great way of improving relationships among people. Paul Coudamy has designed a pod in which two members of a certain workforce may gather together to collaborate in a more personal fashion than the typical business setting would generally offer (trendhunter.com).

4.2 Patent Search

Our group did not come across any patents that accurately represented our product, since it was generated from our design team. However, there were a few patents that we found that deal with cardboard furniture. Patent Number: 4,934,756 is the closest one that represents our piece of furniture. This patent describes the effects of interlocking pieces of cardboard furniture with other pieces in order to form an egg crate shaped design. Although we did not actually use this design, it was a very possible option for the design of the back rest for our chair.

4.3 Benchmarking

Our product compared with other marketable designs. Our design was able to hold a fair amount of weight in comparison to the weight capacity of the marketed chairs. Although our chair lacked some weight capacity and comfort, it made up for those results with storage capabilities, transportation capabilities, easily assemble, and it was customizable. The benchmarked chair is also overpriced in comparison to our product. However, the marketed chair was just too good in comparison to our product in actually being a very comfortable reclining chair to overcome. Our chair is meant to be cost efficient, whereas the marketed chair was meant to actually preform its purpose to the best of its abilities. While our chair can compete with the marketed chair, it will not surpass it because it is an alternative.

Benchmarking of Two Products

Table #2 Benchmarking Products Table

Selection Criteria	Weight %	Your Product			1450 Series			1555 Series		
		Ranking	Value (lbs.)	Weighted Score	Ranking	Value (lbs.)	Weighted Score	Ranking	Value (lbs.)	Weighted Score
Weight supported (lbs)	100%	2	At least 180	3	1	275	5	1	275	5
Cost ($)		126			$699			$699		
Comfort		3			5			5		
Transportation		5			2			2		
Ease of Assembly		5			2			2		
Total Score Rank		4.5			2.5			2.5		

5.0 Target Specification

Our target specifications were set in order to meet the demands set forth by our professor. The cardboard chair had to be useful in the college dorm room setting while also pricing at an affordable cost. The chair had to be collapse in order to be stored underneath the average dorm bed. The chair had to be priced exceptionally cheaper than most other forms of furniture. The chair had to be sturdy enough to hold a load of 80 lbs. as well as be durable enough to take the wear and tear of a college student. While upholding all of these requirements, the chair also had to be aesthetically pleasing so that it would be marketable in comparison to other variations of furniture.

Table #3 Target Specifications Table

Feature	Current Specs	Target Specs	
		Ideal	**Marginal**
Cost	$126	<$100	<126
Capacity (lbs.)	At least 180	80	80
Height (inches)	38	38	38
Width (inches)	20.5	20.5	20.5
Depth (inches)	28.5	28.5	28.5
Ease of use	5	5	5

6.0 Concept Generation

Table #4 Concept Generation Table

Design #	Type of Design	Function
1	Chair	Lounge chair
2	Chair	Better looking lounge chair
3	Chair	Possible kitchen chair
4	Chair	Chair with defined edges

Figure 1 Design #1: The design Team's first conceptual design of the chair. The primary function was just a basic lounge chair.

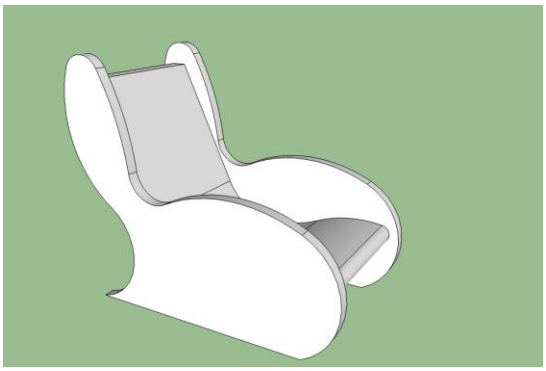

Figure 2 Design #2: A redesigned model of our first chair. The intentions of this design were to make it as aesthetically pleasing as possible.

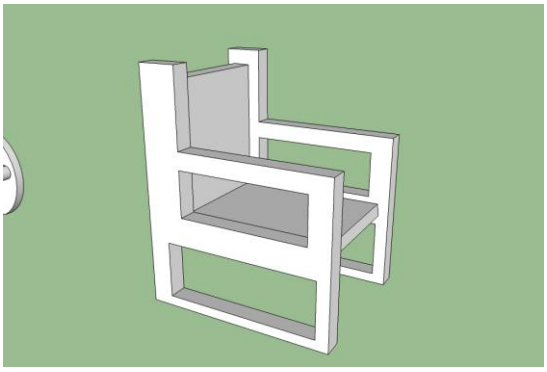

Figure 3Design #3: The intention of this design was to make a kitchen chair that had arm rests, because the typical kitchen table chairs do not.

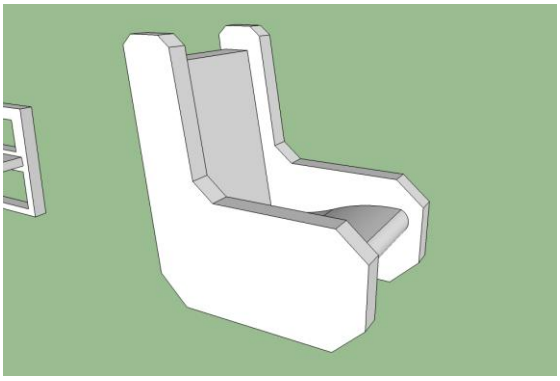

Figure 4 The purpose of this design was to test the aesthetics of a chair with more defined edges and corners. Most chairs are either smooth or pointed, this design exploits both of those qualities.

7.0 Concept Selection

The concepts of our product were selected based on the requirements that needed to be met as well as the importance of them. Some of the concepts were not able to be fit into our overall design because they would take away from the potential of the rest of the product. The design team also had to decide what the purpose of our chair would actually be, and certain qualities that did not directly correlate with that purpose needed to be disposed of.

Table #5 Concept Screening Matrix

Selection Criteria	Design #1	Design #2	Design #3	Design #4
Height (inches)	38	38	38	38
Width (inches)	20.5	20.5	20.5	20.5
Depth	28.5	28.5	28.5	28.5
Aesthetics	4	5	3	2
Ergonomics	4	4	3	4
Cost $	26	26	Less than 26	26
Ease of use	5	5	5	5
Sum +'s Sum 0's Sum –'s				
Net Score Rank Continue?	5	5	3	5

Table #6 Concept Selection Matrix

Selection Criteria	Wt %	Your Product		Target Specifications		Design #2		Design #3	
		Ranking	Value	Ranking	Value	Ranking	Value	Ranking	Value
Weight supported (lbs)	30	1	At least 180	1	At least 80	4	At least 180 lbs	3	At least 120 lbs
Cost ($)	20	2	126	1	<100	3	136	1	100
Aesthetics	30	2	4	1	5	1	5	3	2
Mobility	10	2	4	1	5	3	3	1	5
Ease of Assembly	10	1	5	1	5	2	4	3	3
Rank		#1				#2		#3	
Continue?		yes		NA		No		No	

8.0 Final Specification

The specifications were listed below as the only quantifiable specifications that the design was able to meet. The other specifications that the product should have were all aesthetics and could not be placed into a table.

Table #7 Final Specifications

Feature	Current Specs	New Specs
Cost	$126	126
Weight Supported (lbs)	At least 80	Over 180

9.0 Final Design

The final design that the design team chose for our chair was a design very closely related to Design #1. The chair consisted of more rounded edges; however we were not able to implement all of the design features that were included in Design #1. The seat and back were able to be assembled through holes that were cut into the side panels of the chair. The holes are not visible since the holes in the sides penetrate all except the outside layer of the chair. The back-rest of the chair is able to be assembled the same way.

Figure 5 Chair Support: The right side of the chair.

Figure 6 Backrest: The back-rest consisted of 3 panels within two pieces of cardboard to add both support and aesthetics.

Figure 7 Seat: The seat of the chair was built in many layers so that the cardboard could have the maximum strength possible.

Figure 8 Assembly: Both sides of the chair, the seat, as well as the back-rest are pictured here.

Figure 9 Prototype: The complete assembly of the chair is shown here.

10.0 Conclusions

The overall design was a good solution to the problem. The design was over-designed for the requirements that it was supposed to meet. The design was cost effective, but by no means a true replacement for furniture itself. It is a very cheap alternative, but due to the composition and properties of cardboard, this chair is unable to compete with marketable chairs in its function.

11.0 References

Advertisement. *Almar-furniture*. Web. 25 Feb. 2011. <http://www.almar-furniture.com/product/14-15-Series.html>.

Alter, Lloyd. "Cardboard Conference Cells - The Cellulose Meeting Pod Encourages Interactivity in Workplaces (GALLERY)." *TREND HUNTER - #1 in Trends - Fashion Trends, Tech, Style, Design, Pop Culture and Marketing*. 16 Mar. 2009. Web. 25 Feb. 2011. <http://www.trendhunter.com/trends/cellulose-meeting-pod>.

"Cardboard Furniture - Patent 4934756." *Patent Searching and Inventing Resources*. June-July 1990. Web. 25 Feb. 2011. <http://www.freepatentsonline.com/4934756.html>.

"Http://www.cardboardfurniturestore.com/." *Cardboard Furniture Company | Cardboard Furniture for People on the Go*. Web. 25 Feb. 2011. <http://www.cardboardfurniturestore.com/>.

"Make Your Own Cardboard Furniture." *TreeHugger*. Web. 25 Feb. 2011. <http://www.treehugger.com/files/2009/03/cardboard-furniture.php>.