DESIGN APPROACH FOR YOUTH SPORTS EQUIPMENT:

DESIGNING FOR THE CHILDREN

Owen Daniel Foster, Jr.

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Owen Daniel Foster, Jr.

A Thesis

Submitted to

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THESIS ABSTRACT

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Children are increasingly exposed to more sports activities and organizations and have more opportunities to participate in them than ever before. These activities are viewed as learning and development tools for the youth of today and tomorrow. As a result of this, the sporting goods market offers a wide variety of equipment and supplies that cater to the needs of the consumer. Unfortunately the design behind this youth equipment is simply a smaller scale of the adult model instead of a custom design for children. With children developing in rapid stages, they tend to have different weaknesses and strengths that need to be considered within the design and development of products that would fit their needs better. By taking data from several major fields and studying children playing sports, my thesis will approach the design of youth sports equipment with the child in mind. The focus group will be aimed at the male athlete aged eight to 10

years old. Instead of choosing a broad study of this subject, this thesis is focused on

baseball so as to provide a clear example of the subject in the market. The aim of this

study will be to prove that if sports equipment is designed for children, children have a

greater potential for enjoyment and success in the sport they choose to pursue.

ACKNOWLEDGEMENTS

Style Manual or Journal used: American Psychological Association

Computer software used: Microsoft Word
                                        Adobe Illustrator
                                        Adobe Photoshop

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CHAPTER 1: INTRODUCTION

1.1 PROBLEM STATEMENT

Much of the world views sports activities to be a learning tool for its youth. Even with this being practiced, there seems to be a lack of an approach for designing youth sports equipment that is based on the child. There are many different products that children use that can be explored and developed by a designer. By taking a wide range of data from different fields of childhood development and sports and apply it to this development tool, you can create ideas to improve the lives of these children. Looking at the basic products that children use within their sports, trying to develop or improve them is a huge challenge. The market uses the design for the adult athlete and simply scales down to a youth's size. You must start with the development stages of children. It is more than just the physical aspects that need to be addressed. These development stages are what separate the youth athlete from the adult athlete. He/she can then observe what activities children participate in and how they approach them. Take a look at the number of children that are involved in these activities, such as Little League Baseball, where their organization reports that there are over three million participants on more than 180,000 teams in over sixty countries (Seefeldt & Ewing, 1996). This illustrates how you might have a large impact in this field.

1.2 NEED FOR STUDY

There are many different opportunities to break into youth development through sport

activities. Sports can be used in countless ways to increase the chances for a child to

develop his or her full physical and mental potential. Studies show that in-depth research

of the capabilities and limitations of children can start identifying activities that will push

development within different stages of a child's life (Hoorn, 2003). Despite research that

has gone into sports and design that has been used in equipment used with these sports,

designers have forgotten the most basic element: the child. Design is preoccupied with

the development of equipment for the adult athlete. In this study, issues such as

developmental stages of children, interaction communication, safety concerns, and the

basic need for enjoyment will be explored to see how sports and the equipment used can

enhance a child's experience and further help them mature (Humphrey, 2003). Though

this study will be based on young male athletes of the eight to 10-years-old range, the

data and practices can be applied as a base line for other groups of children. The goal of

these ideas and documentation is to further the potential of our children today and in the

future.

1.3 OBJECTIVES FOR STUDY

The following are areas on which this study will focus.

<u>**Objectives**</u>

- Identify the need to create an approach of study for designing and developing

    sports equipment for children ages of eight to10 years.

- Study all means necessary to identify user's capabilities and limitations, products
  needed, interaction communication, safety concerns, rules and regulations, and
  the best way to bring more enjoyment and educational fulfillment to the
  development of children.

- Define the sports field and its interaction with today's youth.

- Create a documentation that will establish a method for the design of youth sports
  equipment.

- Apply found data to construct a working model to show that the ideals of the
  documentation are valid.

1.4 LITERATURE REVIEW

1.4.1 Overview

According to Weiss and Gould in their book <u>Sports for Children and Youths</u>,
sports can be seen as the search and opportunity to test human potential (Weiss & Gould,
1986). Seeing that the early stages of child development mold the lives of children, it is
important to get the most out of this time frame. The exercise generated by sports creates
not only a healthier and fitter being, but can be measured in a child intellectually,
mentally, and socially (Chan & Micheli, 1998). With organized sports, there is special
potential for improving the health of the physically and mentally challenged children, as
well as those with acquired diseases, such as obesity, diabetes or asthma. Sports reach
many people and cultures; it plays a significant role in everyone's lives.

Childhood development was one of the main topics for my research. Child
development as defined by James Humphrey: "an interdisciplinary approach to the study

of children, drawing upon such science as biology, physiology, embryology, pediatrics, sociology, psychiatry, anthropology, and psychology. Emphasis is placed on the importance of understanding: children through study of their mental, emotional, social, and physical, growth. Particular emphasis is laid on the appraisal of the impacts on the growing personality of home, school, and community." (Humphrey, 2003) Even though Humphrey's definition applies to children of all ages, this documentation focused on children in the age range of eight to ten years old.

After reading books and other documents that many child educational leaders have written, most seem to agree that the goal of early childhood education is to stimulate and guide the development of children so that they can function in life activities and possess as high a level of physical, social, emotional, and intellectual well-being as their individual capacities will permit. Most agree that sports offer a medium for which this development can happen.

In recent years, competitive youth sports in the United States have grown with an estimated 35 million participants (Ewing & Seefeldt, 1996). It is likely that these numbers are overstated due to the participation in more than one sport by many youth, nevertheless the obsession Americans have with the importance and value of sports for children. With so many opportunities for the youth to participate in a variety of sports at a variety of skill levels, it is safe to say that sports for children are here to stay.

With such a growth in the number of young athletes, the sports industry has expanded to incorporate the growing market. By using youth baseball according to the NSGA's annual studies, in the year 2003 the sale numbers of baseball gloves reached $155 million (www.sbrnet.com, 2004). With this kind of revenue available, companies

have started creating divisions to design and manufacture equipment that is solely used within youth sports. Equipment that ranges from bats for baseball to pads for football is produced just for this market. While there are improvements within the industry, there are still no standards for designers to use when designing for children. The market is still dominated by the adult athlete.

1.4.2 Printed Research Material

The material I found published ranged from childhood development, sports and its rules and regulations, basic design, to child development through sports. Though helpful, none show how design can help within the realm of youth sports. In fact, I did not find any books that focus on the design of youth sports equipment, or even a standard to follow. Even with all the knowledge these books hold, I felt none actually translate as a guide for youth equipment design.

1.4.3 Internet Research Material

Given the popularity of the internet, I was able to find an array of websites that show information on research, market numbers, and products that are available for youth sports. However, I could not find a source that concentrated on youth sports design information. Knowing the unreliable nature of the internet, I had to be cautious of the information I obtained. Any information I used from the internet, I verified the sources either through printed materials or other noted professional links, such as national associations.

1.5 DEFINITION OF TERMS (www.dictionary.com)

Aesthetic

    1. A guiding principle in matters of artistic beauty and taste; artistic sensibility.

Approach

    1. The method used in dealing with or accomplishing.

Capabilities

    1. The quality of being capable; ability. **2.** A talent of ability that has potential for

development or use. **3.** The capacity to be used, treated, or developed for a

specific purpose.

Child Development

    1. Development of a child's capabilities or potentialities.

Cognitive Development

    1. Of, characterized by, involving, or relating to cognition. **2.** Having a basis in or

reducible to empirical factual knowledge.

Criteria

    1. A standard, rule, or test on which a judgment or decision.

Emotional Development

    1. A mental state that arises spontaneously rather than through conscious effort

and is often accompanied by physiological changes; a feeling. **2.** A state of mental

agitation or disturbance. **3.** The part of the consciousness that involves feeling;

sensibility.

Functional

1a. Of or relating to a function. **b.** Of, relating to, or indicating a mathematical function or functions**. 2.** Designed for or adapted to a particular function or use. **3.** Capable of performing; operative.

Human Potential

1. The inherent ability or capacity for growth, development, or coming into being.

Intellectual Development

1a. Of or relating to the intellect. **b.** Rational rather than emotional. **2.** Appealing to or engaging the intellect.

Interaction Communication

1. The mutual or reciprocal action or influence between the product and user through the exchange of thoughts, messages, or information, as by signals, writing, or behavior. (phrase coined by the author)

Limitations

1. The point, edge, or line beyond which something cannot or may not proceed. **2.** limits the boundary surrounding a specific area; bounds. **3.** A confining or restricting object, agent, or influence.

Moral Development

1. Of or concerned with the judgment of the goodness or badness of human action and character.

Motor Development

    1. Of, relating to, or designating nerves that carry impulses from the nerve centers

to the muscles. **2.** Involving or relating to movements of the muscles.

Obesity

    1. The condition of being obese; increased body weight caused by excessive

accumulation of fat.

Physical Development

    1. Involving or characterized by vigorous bodily activity.

Psychomotor Development

    1. Of or relating to movement or muscular activity associated with mental

processes.

Social Development

    1. Of or relating to human society and its modes of organization. **2.** Inclined to

seek out or enjoy the company of others; sociable.

Sport

    1a. Physical activity that is governed by a set of rules or customs and often

engaged in competitively. **b.** A particular form of this activity.

Technology

    1a. The application of science, especially to industrial or commercial objectives.

b. The scientific method and material used to achieve a commercial or industrial

objective.

1.6 ASSUMPTIONS OF STUDY

It is assumed that the sources used and/or quoted the research in this study have been proven, and widely acknowledged as true. Also, the methods and procedures used in this documentation only represent one of many possibilities available to a designer, and neither more or less valid than others currently proven. The sports field is so vast and the designs within it may hold parallels in techniques and approaches within its many divisions. Therefore, those that are used in this thesis refer strictly to youth sports equipment and mainly those used in youth baseball.

1.7 SCOPE AND LIMITS OF STUDY

This study's outcome is solely based on an approach and suggestion to be used in the design and production of youth sports equipment. This documentation will also offer a physical output to demonstrate these concepts. With this in mind, I will not engage in user or safety testing of the objects produced through this approach.

The documentation of this thesis was current upon completion, and will not be updated or adjusted in any way after that time. All measures will be taken to employ current data and technology available to ensure that the documentation is current and accurate.

1.8 PROCEDURES AND METHODS

The goal of this documentation is to create and produce an approach to designing youth sports equipment that identifies and considers the capabilities and limitations of the

users. The following is a list that indicates the procedures and methods used with this approach.

- **Research:**
  - o *Childhood development-* Identify the difference in developmental stages of children.
  - o *Youth sports-* Look at the vast array of youth sports and what they offer.
  - o *Trends within youth sports-* Understand the impact and bonds between children and sports.
- **Development:**
  - o *Concepts-* Work to develop ideas and concepts of the equipment through the use of sketching and models.
  - o *Production-* Construct and document production methods in all stages taken in the development of a product.
- **Communication:**
  - o *Analyze-* Demonstrate that the steps used in the process were accurate.
  - o *Finalize-* Overview of the entire approach, process, and product.

1.9 ANTICIPATED OUTCOME

There will be several outcomes at the conclusion of this study: 1. An understanding and approach to the design of youth sports equipment. 2. A fully functional product will be produced for a target group playing baseball in order to verify the approach of this documentation. 3. A designer should be able to use and evaluate this approach and apply the information to his/her designs.

CHAPTER 2: DESIGN FACTORS

2.1 OVERVIEW

Within the methodology of design the phrase "The Design Process" is stated frequently. Even though a process or an approach is used, an exclusive process does not exist. You must devise and deliver your own process based upon the lessons taught and views believed. This documentation will express the guide of design practiced by me.

2.2 FUNCTION OF A PRODUCT

According to Dr. Walter Schaer, a retired Auburn University design professor, there are three functions of a product. In order for products to be complete, these three areas should be addressed; Human Function, Technical Function, and Production Function. An understanding of the three will apply a solid foundation upon which a designer can build from.

- **Human Function**- is the relationship of the product to the user. It is based on three human needs.
    - *Social Economics*- Focuses on price quality and accessibility of the product.
    - *Cultural Aesthetic*- Focuses on how a society views the form quality of the product

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- o *Practical Physiology*- Addresses the product's functional relation with the user.
- **Technical Function**- the relationship of a product to its own parts and other objects and forces in its environment.
  - o *Direct Technical Function*- relationship of a product to its own parts and components.
  - o *Indirect Technical Function*- relationship of a product to other objects in its own environment.
- **Production Function**- relationship of the product to its planning and manufacturing.
  - o *Planning*- addresses the distribution strategy and marketing of the product.
  - o *Manufacturing*- Addresses the actual production of the product.

2.3 CONCEPT FOR THE PROJECT

One must have a solid design concept and understanding of the focus of the design in which a project can be built. At the forefront of the process, this concept is one of the most important steps of the designing process. If one neglects the planning and understanding, portion of design future development might have to be corrected to have a complete product. In dealing with the design of sports equipment for the young athlete, the process often begins with the client choosing the sport, age range, and the style of equipment to be used. Once this has been determined, the designer must generate the use, general concepts for the product, distinctive characteristics, and possible market plans. Idea sketching will then take place to generate information of the concept to

explain what might be able to be achieved, and for those in charge to give approval for

the continued development.

2.4 CONCEPT IDENTITY

To assist a project in creating its own identity among a vast market of products,

the designer must lay out a guideline to follow. This guideline will insure that the product

will be successful and improve the chances of entering the market. The following are

examples of a guideline used within this project.

- The product must show a unique difference and improvement over existing

  products within the same field.

- Due to the user being a child, the product must have a strong interaction

  communication.

- The product must assist in the development of the child.

- Features of the product must be able to make an impact and be newsworthy.

- The product must be very marketable.

- The product must have long-term appeal and not be a one-shot design.

2.5 MARKET

Marketing of a product is one of the final factors that a designer must prepare for.

Consider how that product will be sold, in what market, and in what media. Setbacks and

delays occur due to neglecting this portion of the design process. Even though all of the

details do not have to be developed, at least have a plan set into motion for the marketing.

2.6 INITIAL RESEARCH

2.6.1 Childhood Development

There are many forms of development in the early years of childhood and sports, such as social, emotional, physical, intellectual, and motor and moral development (Chan & Micheli, 1998). Motor development is a very broad aspect of physical development. Moral development deals with the capacity of the individual to distinguish between right and wrong.

People are social beings. Even though they see social interaction in almost every aspect of life, social development is still, for the most part, vague and confusing, in childhood. The components of social health for children is different then those of adults in many ways. Even some adults consider children social misfits due to their behavioral difference. Compared to adults, they must be aware of the methods that they use to develop children's social lives.

Emotional development is an ever-changing idea and theory. The emotions of children appear to be more intense than those of adults. Since they determine its strength or intensity by the way they perceive or interpret the situation. If an adult is not aware of this aspect of child behavior, he/she will not be able to understand why a child reacts strongly to a situation that seems somewhat insignificant.

Physical development is a simple concept since it is usually consistent in all children. Bill Bowerman, co-founder of Nike, once said, "If you have a body, you are an athlete." Even though some are short, some are tall, some are lean, and some are obese, everyone will have some physical development throughout their lives. In a sense, children "are" their bodies (Humphrey, 2003).While many aspects of a child's

development is predictable, physical development is case-specific and can therefore be tailored to help children grow and mature into the adults they will become.

Intelligence is a word that is derived from the Latin word *intellectus*, which means the "power of knowing" (Humphrey, 2003). A child can be measured in this area as the capacity to learn and understand. Throughout history there have been a number of ways to approach this form of development. Even intellectual fitness has been considered a practical component of intellectual development. The needs for this fitness include a need for challenging experiences at early stages of development, a need for successful and satisfying experiences, and a need for the opportunity to participate in creative experiences. When teachers, coaches, parents, and other adults understand the intellectual needs and factors that influence intelligence, they are able to help children with their intellectual pursuits more successfully (Humphrey, 2003).

Other developmental terminology, such as the learning domains, which consist of the affective domain, the cognitive domain, and the psychomotor domain are used to describe forms of development. Affective development is ordinarily thought of as being concerned with appreciation and it is sometimes referred to as socio-emotional development, a combination of two of the four main forms. In this context, cognitive development means knowledge or understanding. Psychomotor development involves learning to move with control and efficiency or, more simply stated, skill in movement (Humphrey, 2003).

2.6.2 Youth Sports

History has shown that children have been playing games and sports since the beginning of time. For whatever reasons, either survival or fun, they where more than likely spontaneous in origin. It has only been in the last fifty years or so that the organization of sports competition for children and adolescents by adults has developed (Chan & Micheli, 1998). Sports and games mean different things to many different societies, but almost all have seen the importance of including children.

Many great educators and philosophers see sport activities as a large piece of the total education of children (Humphrey, 2003). Plato suggested that all early education should be a sort of play and develop around play situations. Locke, an English philosopher, felt that children should get plenty of exercise and learn to swim early in life. Rousseau, a French writer, believed that learning should develop from the enjoyable physical activities of childhood. The poet Schiller said, "Man is perfectly human only when he plays" (Erikson, 1985).

In the United States, participation in youth sports has become second nature to children. Organizations such as Little League baseball, Pop Warner football, and Itty Bitty basketball have grown in such a way that it is estimated that over thirty million children are enrolled in them (Ewing & Seefeldt, 1996). These children range in age of six to 17 years old. With numerous reports and documentations showing all of the benefits of children participating in sports, it is clear why so many participate.

2.7 SCHEDULE

With every project, the designer must set a time schedule to insure the project will

conclude in a timely manner. I will use the Gantt chart to visually display what is needed

and when will it be accomplished. Due to its presentation of facts in their relation to

time, the Gantt chart is one of the most notable contributions to the art of management.

The following list shows the uses of a Gantt chart.

- Organizing activities of limited resources.

- Logging work done.

- Comparing work done/projections.

- Assisting distribution of work.

On the following page is an example of the Gantt chart constructed by me to be used

with this project. Notice that it is broken into three major areas: Design Research, Design

Development, and Design Communication. These three areas of design will head the

following chapters to be used as a guide throughout a design project. Also, the full Gantt

chart can be found under Appendix A.

1. Design Research	Sept		
Process Events	Early	Mid	Late
1.1 Identify the needs. Product/System	██	██	██
1.2 Decide on objectives	██	██	██
1.3 Collect and produce information		██	██
1.4 Check operation of the product			
1.5 Prepare comprehensive problem statement			
1.6 Define performance criteria			
1.7 Initial design studies			
1.8 Generalize			
1.9 Use systems approach			
1.10 Analyze and classify information			
1.11 Define constraints			
1.12 Formulate hypothesis of all possible solutions			
1.13 Prepare design specifications			

2. Design Development			
Process Events	Early	Mid	Late
2.1 Concepts			
2.2 Develop design alternatives			
2.3 Erect key models			
2.4 Analyze alternative solutions			
2.5 Validate hypothesis			
2.6 Develop best possible solution			
2.7 Make variation of details			
2.8 Build prototype			
2.9 Simulate actual performance through testing			
2.10 Redesign details			

3. Design Communication			
Process Events	Early	Mid	Late
3.1 Analyze prototype for production			
3.2 Finalize comprehensive design report			
3.3 Present visually and orally			

Table 1- Gantt chart

CHAPTER 3: DESIGN RESEARCH

3.1 INTRODUCTION

As the research phase opens up to the design approach, it refers back to this

documentation and restates information to set the understanding for the project.

Although this approach is standard teaching at Auburn University, it does not grant

success in every situation. Know that every design project will not have the same

research requirements. A designer must modify his/her own data to ensure the project

has the right considerations. It is my belief that the understanding of this approach, the

thought process, and skills displayed in this documentation will aid others to achieve

better results.

3.2 IDENTIFY THE OBJECTIVE

The first information required with the start of the research phase is to identify the

needs and goals of the project. It has been established that the need for this study when

designing equipment for youth sports was to consider the requirements of children.   All

information should be targeted toward topics such as child development, interaction

communication, and the learning and enjoyment of sports.

The target group will be the male athlete between the ages of eight and 10 years

old. This group is a pivotal age, which if encouraged in some way, might change the

dropout rate of youth engagement in sports (Humphrey, 2003). The sport of choice will

be baseball, which is a very mental as well as physical game. With over three million

children participating, this sport can offer a large market if the product proves to be

successful. Most equipment used in the game of baseball has not changed dramatically

over the years. Most changes within the designs concentrate on safety issues. Items such

as face shields, chest protectors, and softer balls are what differ from the adult versions.

This study will offer a variation of the basic glove as it is not solely directed by safety

and more focused on the interaction and education.

3.3 PHASES OF CHILDHOOD DEVELOPMENT

With all the data collected about child development, it was important to consider

all development areas and adjust design according. The following information will be

separated into developmental subjects so that the data can be easily extracted.

3.3.1   Emotional Development

Children tend to be very emotional early in their childhood. Pleasant or

unpleasant, it is very apparent at all times. Patterns of emotions such as joy, affection,

happiness, anger, sorrow, and fear, fill their lives and are normal. The goal of

development is to help children to stabilize and understand their emotions (Merrell,

2003).

Sports tend to be a type of guidance for a child to learn emotional development.

Through the pure enjoyment of play and the security of belonging, a child matures

emotionally and find fulfillment of certain emotional needs (Ewing & Seefeldt, 1996).

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3.3.2 Intellectual Development

Children are in need of intellectual development at many different stages. Needs such as challenging experiences at the child's level of ability, intellectually satisfying and successful experiences, solving problems, and a chance for creativity, are important opportunities for the child to develop (Humphrey, 2003).

The freedom of sports for intellectual development needs to correspond with the direct needs and abilities of the child. Different levels of abilities in other developmental stages can be overcome with more forgiveness than in the intellectual stage. A child must understand before he/she will enjoy that activity.

3.3.3 Physical Development

Physical development deals with a child's physical ability to function. This development is continuous and the most noticeable (Humphrey, 2003). Even different parts of a child's body develop at different rates. As the child develops, more difficult types of skills and activities can be introduced. One of the major problems with youth sports is that individual children grow and develop at different rates. This tends to cause problems in assuring a level playing field.

Physical development is measured in sports by certain basic components. Factors such as muscular strength, muscular endurance, speed, agility, and coordination are used to separate children into groups, athletic and non-athletic.

3.3.4   Social Development

Social development is the progression of changes in social behavior, feelings, attitudes, values, and interactions with others that start at birth and ends with death (Humphrey, 2003). This development is what most people praise when speaking of children and sports. Concerning the development stages that have been studied, the development of social skills within sports is the most documented.

While the physical development of a child is easy to identify, the components of social development do not have the same initial visual impact. Some of the less conspicuous needs of a child include: the need for affection, the need for belonging, and the need for mutuality. These needs can be met by involvement in many sports and sports activities.

3.3.5   Developmental Breakdown by Age

The following pages contain visual charts and data that will display the development progression of the focus group in this study (chart information provided by Humphrey, 2003). With a better understanding of the information, we can deliver a better product. Information will consist of all developmental stages covered in this documentation. After reading this thesis, you will be able to see and extract information needed by an individual that will help meet his/her needs.

Listed below is the key for the following charts

Blue**: lower range of average**   **Red****: upper range of average**

Eight-Year-Old Children
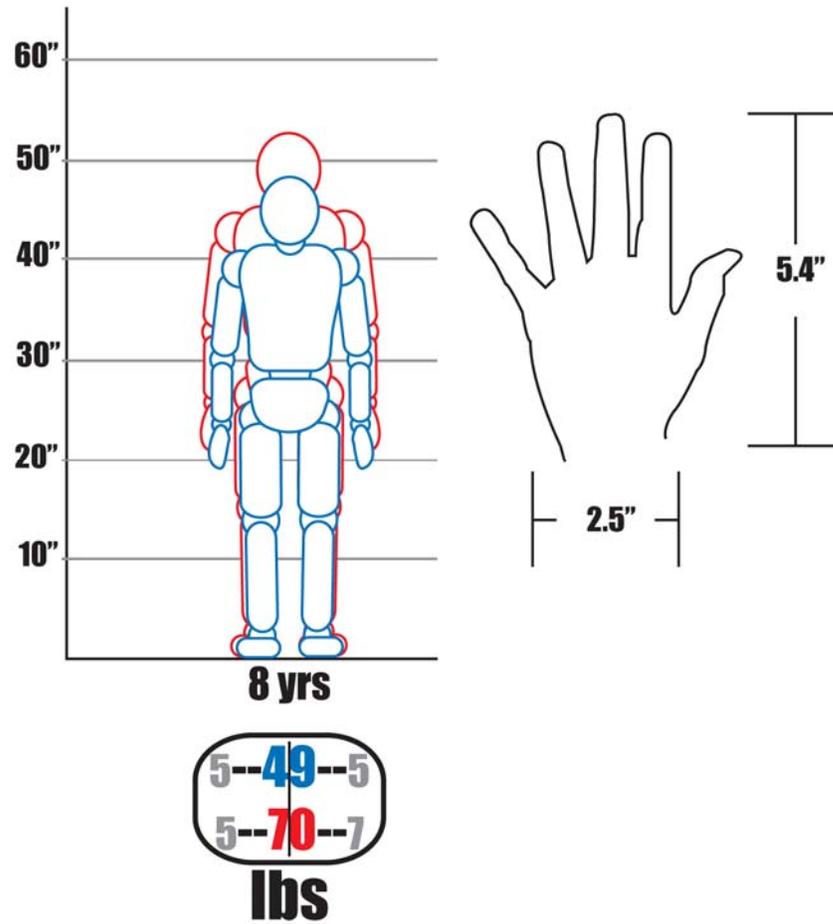
Figure 1- Growth chart

- **Emotional Development**

  o Dislike of criticism from adults.
  o Able to give and take criticism in own group.
  o May develop enemies.
  o Dislike being treated as children.
  o Have marked sense of humor.
  o First impulse is to blame others.
  o Become more realistic and want to find out for themselves.

- **Intellectual Development**

  o Voluntary attention span increasing.
  o Interested in far-off places, and ways of communicating now have real meaning.
  o Becoming more aware of adult world and their place in it.
  o Ready to tackle almost anything.
  o Show a capacity for self-evaluation.
  o Like to memorize.
  o Not always good at telling time, but very much aware of it.

- **Physical Development**

  o Interested in games requiring coordination of small muscles.
  o Arms lengthening and hands growing larger.
  o Eyes can accommodate more easily.
  o Poor posture in some children.
  o Frequent accidents at this age.
  o Appreciate correct skill performance.
  o Grip strength permits steady 12-pound pressure.

- **Social Development**

  o Not careful of their clothes.
  o Leave many things uncompleted.
  o Have special friends.
  o Have longer periods of peaceful play.
  o Do not like playing alone.
  o Enjoy dramatizing.
  o Start collections.
  o Enjoy school and dislike staying home.
  o Like variety.
  o Recognition of property rights is well established.
  o Respond well to group activity.
  o Interests in friends of own sex.
  o Beginning of the desire to become a member of a club.

Nine-Year-Old Children
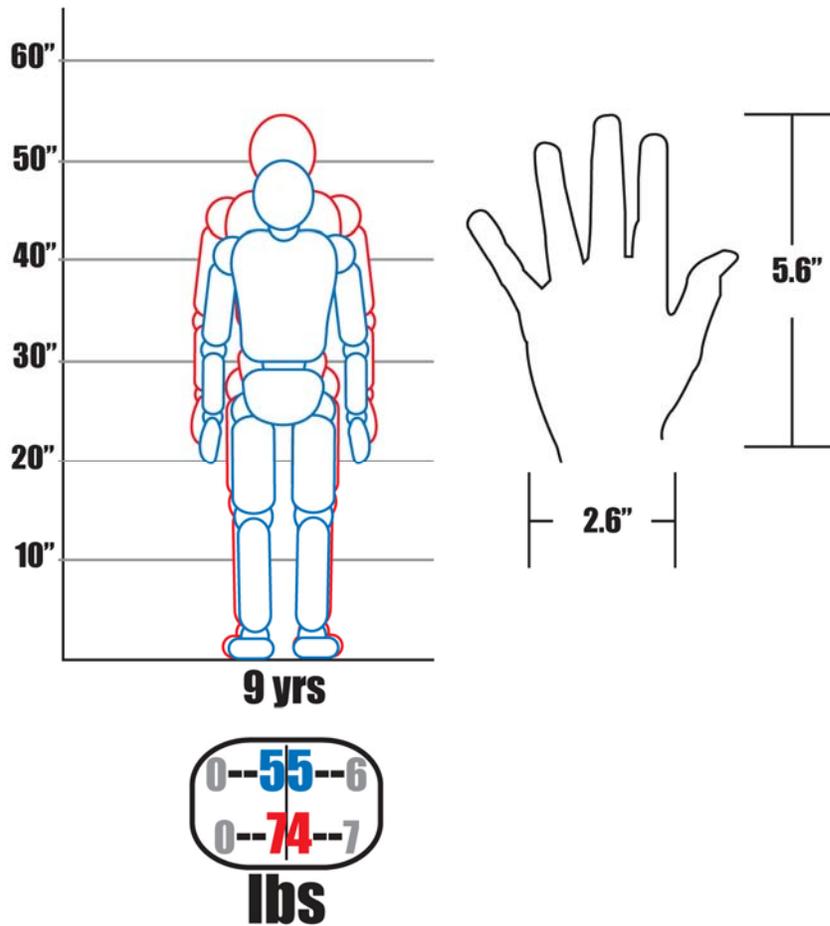
Figure 2- Growth chart

- **Emotional Development**

  o May sometimes be outspoken and critical of the adults they know.
  o Respond best to adults when treated as individuals.
  o Like recognition for what they have done and respond well to deserved praise.
  o Likely to be backward about public recognition but like private praise.
  o Inclined not to change plans in the middle of an activity, but would rather begin over.
  o May fear being deprived of mother.
  o Some definite personality traits evidenced.
  o Are learning to get along better, but still may fight.
  o Like to be trusted with errands.
  o Enjoy performing simple tasks.

- **Intellectual Development**

  - o Individual differences clear and distinct.
  - o Some real interests beginning to develop.
  - o Beginning to have a strong sense of right and wrong.
  - o Understand explanations.
  - o If a project fails to hold interest, it may be dropped without further thought.
  - o Attention span greatly increased.
  - o Seem to be guided best by a reason.
  - o Ready to learn from occasional failure of their judgment.
  - o Able to make up their own minds and come to decisions.
  - o Wide range of interest in reading.
  - o Will average between six and seven words per remark.

- **Physical Development**

  - o Increasing strength in arms, hands, and fingers.
  - o Endurance improving.
  - o Need and enjoy much activity.
  - o Group games full of spontaneous energy.
  - o Likely to slouch and assume unusual postures.
  - o Eyes much better developed and able to accommodate to close work with less strain.
  - o May tend to over exercise.
  - o Can jump vertically to a height of 10 inches.
  - o Can run 16 ½ feet per second.
  - o Can throw a ball 70 feet

- **Social Development**

  - o Want to be like others.
  - o Are generally conformists and may be afraid of that which is different.
  - o Able to be on their own.
  - o Able to be fairly responsible and dependable.
  - o Developing some firm and loyal friendships.
  - o Increasing development of qualities of leaders and followers.
  - o Increasing interest in activities involving challenges and adventure.
  - o Increasing participation in varied and organized group activities.

Ten-Year-Old Children
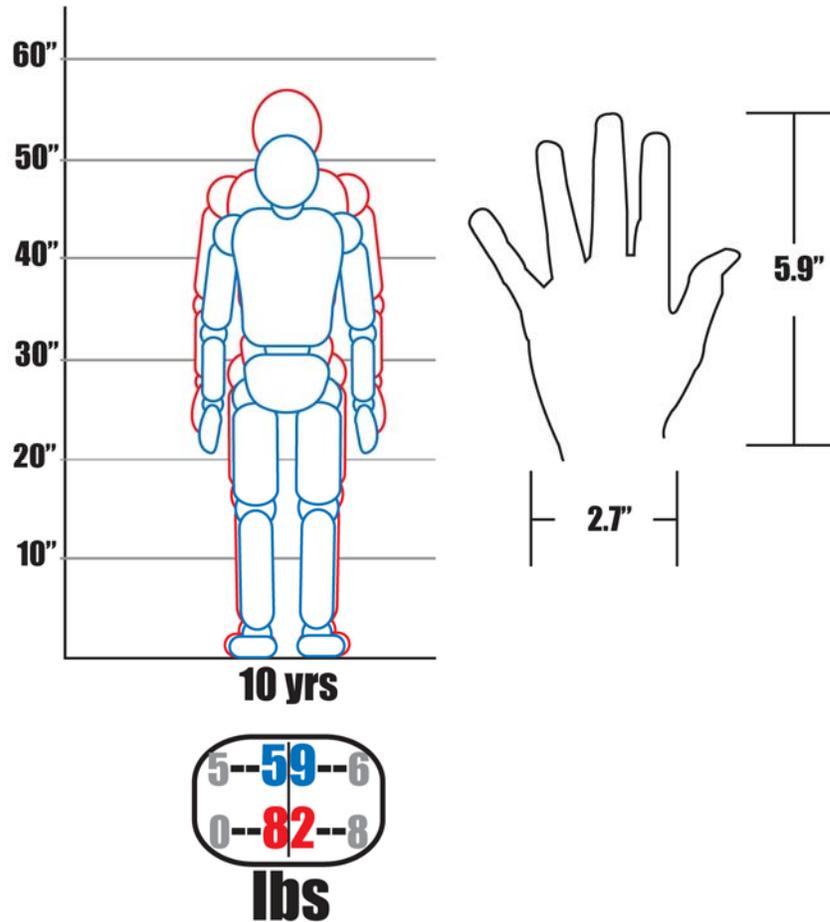
Figure 3- Growth chart

- **Emotional Development**

  o Increasing tendency to rebel against adult domination.
  o Capable of loyalties and hero worship.
  o Can be readily inspired to group loyalties in their club organization.
  o Like the sense of solidarity that comes from keeping a group secret as a member of a group.
  o Each sex has an increasing tendency to show lack of sympathy and understanding with the other.

- **Intellectual Development**

  o Work with executive speed and like the challenge of mathematics.
  o Show a capacity to budget time and energy.
  o Can attend to a visual task and at the same time maintain conversation.
  o Some become discouraged and may give up trying when unsuccessful.
  o The attention span has lengthened considerably, and they are able to listen, follow directions, and retain knowledge more easily.
  o Beginning understanding of real causal relations.
  o Making finer conceptual distinctions and thinking reflectively.
  o Developing a scientific approach.
  o Better oriented with respect to time.
  o Ready to plan the day and accept responsibility for getting things done on time.

- **Physical Development**

  o Individuality well-defined, insight more mature.
  o Stability in growth rate and stability of physiological processes.
  o Physically active and like to rush around and be busy.
  o Before onset of puberty, do not appear to gain in either height or weight.
  o Interested in the development of more skills.
  o Reaction time improving.
  o Muscular strength slower to develop than body growth.
  o Refining and elaborating skill in the use of small muscles.
  o Can judge and intercept pathways of small balls thrown from a distance.

- **Social Development**

  o Begin to recognize the fallibility of adults.
  o Moving more into a peer-centered society.
  o Amazingly self-dependent.
  o Increased self-reliance; intensified group feelings.
  o Widening divergence between the two sexes.
  o Great team loyalties developing.
  o Relatively easy to appeal to their reason.
  o On the whole, they have a fairly critical sense of justice.
  o Increased interest in people, in the community, and in affairs of the world.
  o Interested in social problems in an elementary way and like to take part in discussion.

3.4 INJURIES OF SPORTS

While being a very important topic and consideration of designing for the young athlete, this project will not concentrate solely on the aspect of injury prevention. With this being stated, research was conducted to understand the basic and various types of sports injuries. Sometimes, despite your best efforts to prevent your child from getting hurt while playing sports, an injury may occur. The sections below show information on basic and common types of injuries that occur in sports (Birrer & Brecher, 1987).

3.4.1 Basic Sports Injuries

- -**Sprains and Strains**: A sprain is an injury (over-stretching or tearing) to a ligament. A ligament is a band of tissue that connects two or more bones at a joint and prevents excessive movement of the joint. A strain is an injury to either a muscle or a tendon. A tendon is a tough, fibrous cord of tissue that connects muscle to bone, allowing the muscle to move the bone at the joint.

- **Growth Plate Injuries**: The growth plate is the area at the end of the long bones (in fingers, the outer bone of the forearm, the collarbone, the hip, the bone of the upper leg, the lower leg bones, the ankle, and the foot) in growing children and adolescents. When growth is complete, sometime in the teen years, the growth plate is replaced by solid bone.

- **Repetitive Motion Injuries**: Stress fractures (where the ligament pulls off small pieces of bone) and tendonitis (inflammation of a tendon) occur from overuse of muscles and tendons. While they may not show up on x-rays, they do cause pain and discomfort.

3.4.2 Common Types of Sports Injuries

- **Acute Injuries**: Acute injuries occur suddenly and are usually associated with some form of trauma. In younger children, acute injuries typically include minor bruises, sprains, and strains. Teen athletes are more likely to sustain more severe injuries, including broken bones and torn ligaments.

- **Overuse Injuries**: Overuse injuries occur from repetitive actions that put too much stress on the musculoskeletal system. Although these injuries can occur in adults as well as children, they are more problematic in a child athlete because of the effect they may have on your child's bone growth. Any child who plays sports can develop overuse injuries, although the more time your child spends on the sport, the more likely your child is to experience an overuse injury.

  Overuse injuries can be caused or aggravated by:

  - growth spurts
  - inadequate warm up
  - excessive activity (for example, increased intensity, duration, or frequency of playing and/or training)
  - improper technique (for example, overextending on a pitch)
  - unsuitable equipment (for example, nonsupportive athletic shoes)

- **Reinjuries**: Another common sports injury is reinjury. Reinjury occurs when an athlete returns to the sport before a previous injury has sufficiently healed. Although an injured athlete may want to return to the game prematurely, an athlete is at a much greater risk for reinjury when recovery isn't complete.

Returning to the playing field before a previous injury has completely healed

places stress upon the injury and forces the body to compensate for the weakness,

which may put the athlete at greater risk for injuring another body part.

* eye injuries, including scratched corneas, detached retinas, and blood in the eye.
* brain injuries, including concussions, skull fractures, brain hemorrhages, and spinal cord injuries.

* Swimmer's shoulder is an inflammation (swelling) of the shoulder caused by the repeated stress of the overhead motion associated with swimming or throwing a ball. The pain typically begins intermittently but may progress to continuous pain.

* Little League elbow: Repetitive throwing sometimes results in pain and tenderness in the elbow. The ability to flex and extend the arm may be affected.

* Spondylolysis often resulting from trauma or from repetitive overextension, twisting, or compression of the back muscles causes persistent lower back pain. Spondylolysis is commonly seen in football, weight lifting, gymnastics, wrestling, and diving.

* Anterior knee pain is pain in the front of the knee under the kneecap. The knee will be sore and swollen due to tendon or cartilage inflammation. The cause is most commonly muscle tightness in the hamstrings or quadricep.

* "Shin splints" refers to pain along the shin or front of the leg.

* Ankle sprain occurs with a twisting injury, and may involve the lateral ligaments, medial ligament or the ligaments connecting the lower tibia and fibula.

Figure 4- Injury Chart

3.5 COLOR

Color plays an important role in the world in which we live. Color can sway thinking, change actions, and cause reactions. Regardless of whether people understand the science that is involved with light waves bouncing off surfaces into the eye, they all have been moved, aroused, inspired, and informed by color.

For this study, color will be examined for the use of interaction communication between the user and product. A basic knowledge of color and how it is used must be obtained before applying to the project. The research will begin with the examination of the color wheel.

A color wheel is a visual representation of colors arranged according to their chromatic relationship (Krause, 2002). Begin a color wheel by positioning primary hues equidistant from one another, then create a bridge between primaries using secondary and tertiary colors.
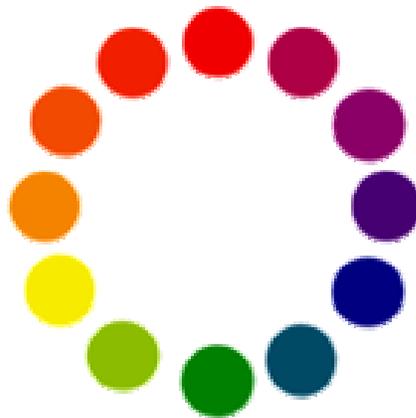
Figure 5- Color Wheel

Figure 6- Color Wheel: Primary Colors
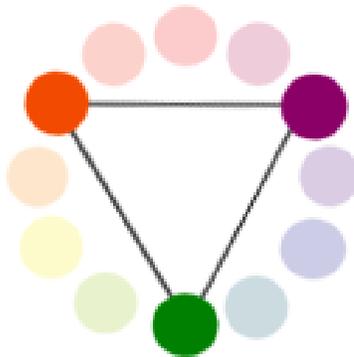
Figure 7- Color Wheel: Secondary Colors

Figure 8- Color Wheel: Tertiary Colors

The color wheel can now be divided into ranges that are visually active or passive. Active colors will appear to advance when placed against passive hues. Passive colors appear to recede when positioned against active hues.
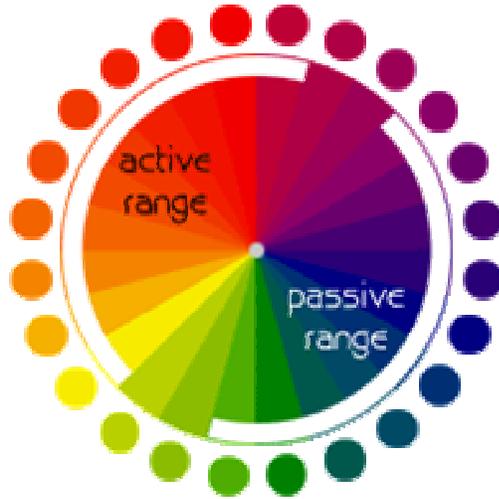
Figure 9- Color Wheel: Passive and Active Colors

Now that the wheel has been divided into two ranges, the project seems to lean toward the use of the active range. Warm colors rev us up and get us going. The warmth of red, yellow, or orange can create excitement (Krause, 2002). Warm colors convey emotions simple optimism and energy. The neutrals of black and brown also carry warm attributes.

3.6   YOUTH BASEBALL

To understand what to design, the sport itself must be understood. Baseball has been a staple of American culture and pastime. Soldiers of the Continental Army played baseball at Valley Forge during the American Revolution. U.S. citizens played more modern versions of the British games of cricket and rounders, often called "town ball,"

through the early 19th century. In the 1840s, New Yorker Alexander Joy Cartwright and his acquaintances played a game called "base ball" that was very similar to the game we know today.

3.6.1   History of Youth Baseball

Every since the creation of baseball, children have emulated their adult heroes and played whenever and wherever they could. In the 1920s, the American Legion formed a baseball program for teenage boys that still exist today. Schools across America soon followed and also started baseball programs for the youth (www.littleleague.org, 2004).

In 1938, Carl Stotz wanted to provide an organized baseball league for the boys of his hometown, Williamsport, Pennsylvania. Experimenting with things such as field dimensions and equipment, Carl enlisted his wife and brothers' families to form the first Little League board of directors. From those humble beginnings, Little League Baseball has become the world's largest organized youth sports program (www.littleleague.org, 2004). In six decades, Little League grew from three teams to nearly 200,000 teams in 50 U.S. states and more than 80 countries.

Though the Little League organization is best known, there are others. These include Dixie Youth, Babe Ruth, Pony, and World Youth baseball, all growing in popularity. They all have the same goals: to give children a game that provides fundamental principles including sportsmanship, fair play and teamwork, and developmental skills they can use later in life. The large numbers of children playing baseball demonstrate there are plenty of these developmental skills being learned.

3.6.2 Today's Numbers

Millions of children participate annually in youth baseball. Understanding the motives of children and their interest or lack of interest in involvement is extremely important. Studies have shown that children participate in youth baseball for a number of reasons. Reasons include having fun, finding something that they are good at, staying in shape, learning a new skill or improving their skills, and being part of a team (Seefedt, Ewing, & Walk, 1992). Recognizing motives such as these can be invaluable for a designer. First, the word 'fun' is the main focus of children. This study will also use 'fun' as the foundation on which it builds the design. Second, the developmental stages resurface and are noticed to be important to young athlete as well as parents. The most surprising aspect of this data is that 'win' is not even mentioned (Seefedt, Ewing, & Walk, 1992).

Children enjoy the interaction and activity of sports. However, this can also be the same element that pushes children away. The children who feel confident about their skill levels and abilities tend to have a larger participation rate. Those who are late developing tend to not get involved or discontinue involvement with sports entirely. My main objective in this study is to make children feel that they can compete on a level playing field as well as have greater enjoyment and interaction level with their sport of choice.

The first chart demonstrates the participation rate of children in baseball for 1993 through 2003 (www.sbrnet.com, 2004). Information gathered from this data is that there are consistent numbers and increasing market needs.

Item	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
All Participants (nos. in mil.)	16.7	15.1	15.7	14.8	14.1	15.9	16.3	15.7	14.9	15.5	14.6
Frequent Participants (50+ days/yr) (nos. in mil.)	4.7	3.5	4.1	4.2	3.4	4.3	4.8	4.7	5.0	4.9	5.6

Table 2- Baseball Participation: Total vs. Frequent Participation

Item	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
7-11 (8.5% of U.S. Pop.)	32.5	33.8	34.6	30.6	33.5	29.7	29.8	31.4	31.3	32.5	30.9
12-17 (9.9% of U.S. Pop.)	31.7	27.5	28.9	28.0	26.0	27.2	24.9	25.4	27.5	25.2	27.9

Table 3- Baseball Participation: Total Participation by Age Group (% of Participation)

Item	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
7-11 (4.1% of U.S. Pop.)	25.7	28.2	27.8	25.0	27.1	23.0	24.5	23.5	24.6	25.4	23.0
12-17 (4.8% of U.S. Pop.)	26.5	23.4	22.3	22.5	20.1	20.5	19.7	19.8	22.5	18.7	23.9

Table 4- Baseball Participation: Male Participation by Age Group (% of Participation)

Even with such great numbers, the other side to this equation can not be overlooked. After the age of 10, there seems to be a dilemma with children quitting baseball. Many think it is because the children start to separate into different ability levels. Issues that can contribute to these different ability levels include: developmental maturity, natural abilities, and understanding the game.

		Age 10	Age 11	Age 12	Age 13	Age 14	Age 15	Age 16	Age 17
Baseball		8.5	12.5	14.9	14.0	13.9	13.8	9.7	6.6

Table 5- Baseball Participation: Dropout by Age (% of Dropouts)

My goal is to achieve a narrowing of this gap and extending a child's interest level in sports. While natural developmental abilities cannot be controlled, game knowledge and overall enjoyment can be considered during the design process.

3.7 THE GLOVE

Baseball players take the use of the old ball glove for granted. This has not always been the case. The first gloves were used in the 1870's and did not resemble today's gloves. The glove was a simple pad that added a small amount of cushion for the hand. It was not designed to catch, but rather to knock the ball down. Ballplayers of this era thought that anyone who used a glove was soft and not real men (www.baseballgloves.com, 2004).

It was not until Albert Spalding came along in 1877 that wearing gloves became popular with fans and players. The history of baseball gloves recounts that the popularity of Spalding coupled with his desire to make money from selling baseball gloves in his sporting goods store led to the acceptance of baseball gloves.

With a livelier ball quietly introduced into the 1910 World Series, the baseball glove finally secured its place in the game. It still took another 90 years for the baseball glove to be perfected; this perfection was achieved when Wilson introduced the Wilson A2000 in 1957.

Figure 10- Glove Design: 1870's

Figure 11- Glove Design: 1910's -1920's.

Figure 12- Glove Design: 1930's.

Figure 13- Glove Design: 1950's-60's

The "Baseball Glove" utility patent was invented by William P. Whitley (www.patentmuseum.com, 2004). This is the utility patent for a baseball mitt which was endorsed by Jim Bottomley. In 1922 Mr. Whitley was issued a patent for his invention from the United States Patent & Trademark Office (USPTO). There were two documents on file for this patent. The drawing specification sheet of the patent has been reproduced on parchment paper, matted and ready to install into an 8" x 10" frame. The other sheet reproduced from the USPTO documents describes the scope of his invention in formal terms:

"Be it known that I, William P. Whitley, a citizen of the United States, residing at St. Louis, Missouri, have invented a certain new and useful Improvement in Baseball Gloves, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same. This invention relates to baseball gloves, and has for its main object to provide a baseball glove that will not rip at the joints or crotches between the fingers and between the thumb and first finger."...

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Figure 14- Glove Patent: William Whitley 1922

3.7.1 Breakdown into the Basics

The basic knowledge of glove design is that it is divided into many different categories. Like the hands they fit, gloves have different strengths and weakness. Gloves come in various sizes, styles, features, position specific, and materials that best suit the game of the athlete.

First, it is important to understand the basic design and styles of the glove. Key and basic elements make up what a glove's appearance and function are. These elements include of the webbing, pocket, backing, wrist adjustments, and padding. The following explains each component in detail.
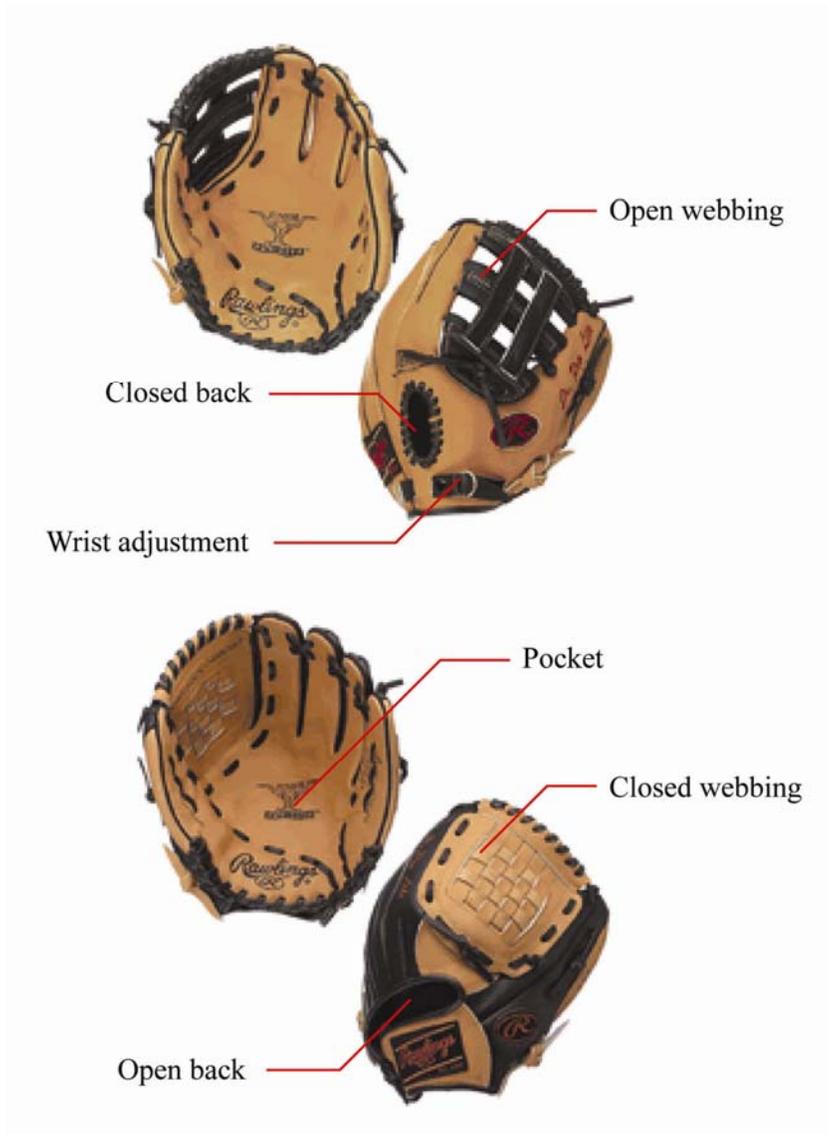
Figure 15- Glove Parts: Basic Glove Parts

- **Webbing**

  o Closed web: Outfielders and third basemen prefer closed web gloves, or knitted baskets without an opening, because they provide extra support. Also pitchers choose to use closed webbing to help hide the ball from the batter.

- o Open web: Middle infielders prefer open webs that have spaces between each piece of leather webbing. They help the infielder to get the ball out of his/her glove quicker to make throws.

- **Pocket**

  - o Shallow pockets: really help middle infielders quickly grab the ball and throw.

  - o Deeper pockets: tend to be used by outfielders to shag down fly balls.

- **Backing**

  - o Conventional/open: This backing leaves a space open across the glove's back. Middle infielders generally prefer this for the flexibility.

  - o Closed: features a smaller hand opening and finger hole for added grip. This type of backing is usually preferred by outfielders.

- **Wrist adjustment**

  - o D-ring fastener: allows the user to pull on the lacing and make the glove tighter or looser.

  - o Velcro fastener: offers convenience of pulling and adjusting to fit the user, although it may wear quicker.

  - o Lacing adjustments: allows the user to loosen or tighten the wrist fastener with leather laces.

  - o Buckle system: adjusts the glove with a buckle similar to an adjustable hat.

- **Padding**

  o The amount of padding depends on the player's preference.

  o Mitts tend to have the most padding due to the amount of hard throws for the pitcher.

  o Padding may also be found in the wrist area for comfort.

The next diagrams show detailed dissection of a glove. These pieces will be very important when constructing the product. Using an exploded view drawing and glove layout I will consider how each part interacts with the others.
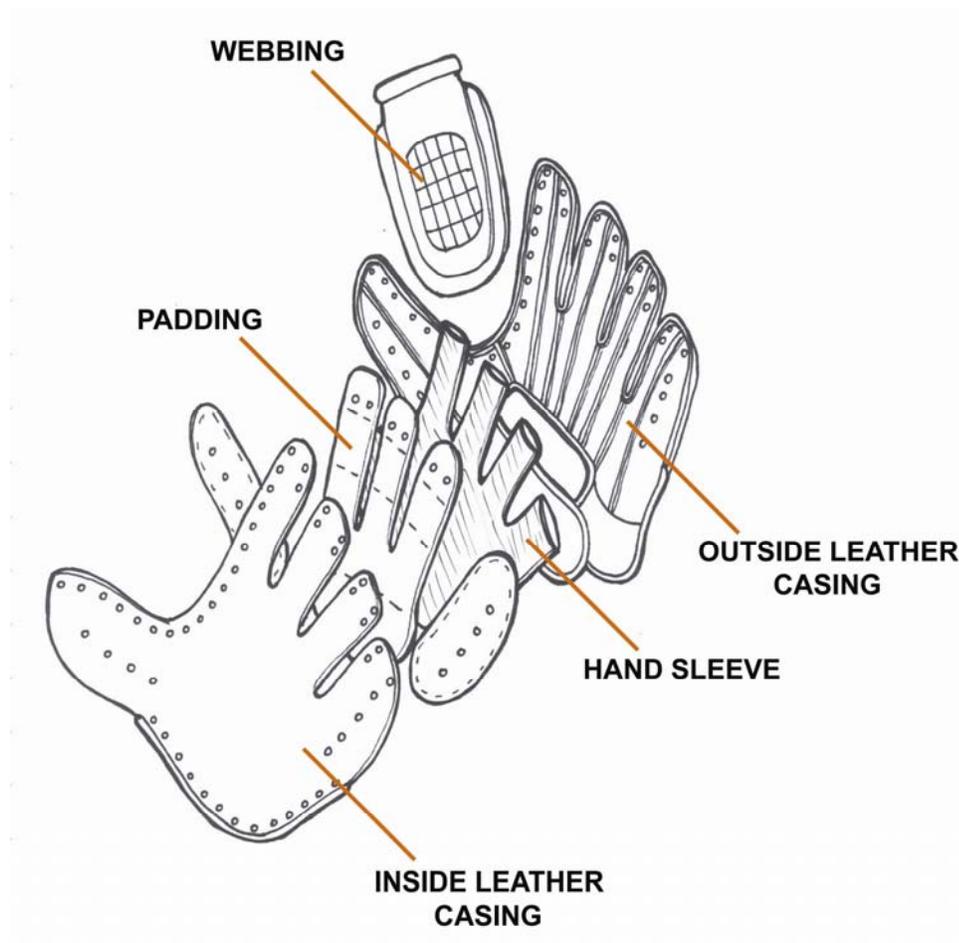
Figure 16- Glove Parts: Exploded View Drawing
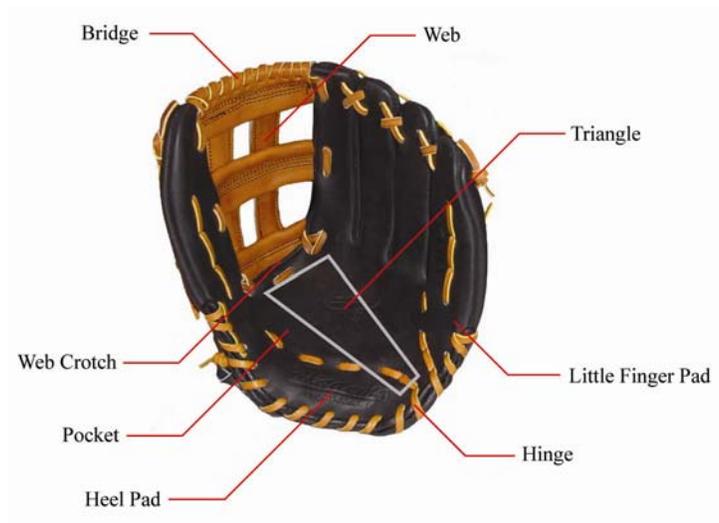
Figure 17- Glove Parts: Dissection of a Glove

3.7.2 Fitting the Position

A player will also choose a type of glove based on the position that the athlete plays. He/she can choose from the following list of position gloves: catcher mitt, first base mitt, infielder glove, and outfielder glove. Some key features to look for are:

Figure 18- Catcher Mitt

- **Catcher mitt**

  o Heavily padded with a thumb pocket and mitten design instead of fingers.
    The design helps to cushion the impact of hard pitches and protects the
    ball during tags.

Figure 19- First Base Mitt

- **First base mitt**

  o **S**imilar to a catcher mitt, but with less padding, a shallower pocket, and
    longer reach. This assists in helping retrieve infielder throws and scoop up
    short-hop balls.

Figure 20- Infielder Glove

- **Infielder glove**

    o Shorter, five-finger glove that features a shallow pocket for rapid transfer

       of the baseball to an infielder's throwing arm.

Figure 21- Outfielder Glove

- **Outfielder glove**

    o Longer, five-finger glove with deeper pockets that cushion the impact of

       fly balls. The extra length increases the reach and range of the fielder.

3.7.3 Materials

     With different materials being used to manufacture gloves, the consumer must choose on the feel and durability of the materials. Materials range from cow hide to kangaroo skin. The more exotic the hide the higher the cost. But all materials can be put into three categories: leather, treated leather, and synthetic materials (www.baseballcorner.com, 2004). Listed below are details that describe each of the three categories.

- **Leather**
    - o Choice material for most gloves.
    - o Offers the best comfort, control, and feel.
    - o The better the leather, the better the glove.

- **Treated leather**
    - o Leather is treated and softened with chemicals for faster break-in and increased durability.
    - o Reduces the care needed for the glove.
- **Synthetic materials**
    - o A lighter, less durable material
    - o Less expensive, good for youngsters
    - o Will not withstand wear and tear as well as leather.

3.7.4 Sizing Youth Gloves

With the evolution of the baseball glove, I observed that the evolution of the youth glove is the same evolution. This fact is because the youth glove is a smaller version of its adult twin. The differences between an adult athlete and a youth athlete are well documented. Therefore, why are they still using the same glove design? One argument that designers use is that the child will grow into the glove. Another is that the market will not support two different designs. My approach for this thesis is to demonstrate that proper design will lead to a glove designed for the child athlete. This will increase his/her enjoyment of baseball.

Figure 22- Adult vs. Youth Design: Same Series in Both Youth and Adult Gloves

Since size is what seems to dominate the design of youth gloves, I looked at the standards and reasoning behind this sizing first. One of the biggest mistakes parents make is to buy a glove so that their child can grow into it. Youth models tend to be smaller to help maintain control. Besides the control issue, if a glove is too big, it prevents developing and refining proper skills. The best way for a child to improve, compete and enjoy the levels of sports is to make sure that he/she learns correct

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fundamentals of fielding and catching. This is accomplished by wearing the proper

glove. Shown below is a chart that displays glove sizing by age and position.

Determining Your Glove Size		
Age	Position	Glove Size
8 and under	Infielder	9 inches
8 and under	Outfielder	11 inches
9 thru 13	Infielder	9 to 10 inches
9 thru 13	Outfielder	11 to 12 inches

Table 6- Sizing Gloves

Gloves are measured by starting at the top of the index finger of the glove down

the finger along the inside of the pocket and then to the heal of the glove

www.baseballcorner.com, 2004). Make sure to use a flexible tape measure and not a stiff

ruler. This measuring will ensure that the glove is the right size.

3.7.5 Market Share

Another major concern of manufacturers is if the market can support design for

both youth and adult gloves. As stated before, many children play baseball. Now,

evidence shows the monetary numbers of today's market (www.sbrnet.com, 2004).

Additional information will be displayed in the appendix, (Appendix B thru F).

Item	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Dollars (in mil.)	171.3	155.6	120.6	146.1	150.2	149.8	169.9	162.5	161.6	152.5	155.4
Units (in mil.)	4.9	4.2	3.7	4.3	4.5	4.5	4.6	4.6	4.5	4.4	4.5

Table 7- Baseball Gloves/Mitts: Total Consumer Purchases in Units and Dollars

Item	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Under 14 (19.8% of U.S. Pop.)	60.2	47.9	52.7	53.4	44.3	47.2	48.2	51.5	42.9	45.3	46.0
14-17 (5.7% of U.S. Pop.)	13.7	19.4	17.9	11.6	24.3	21.1	20.2	21.2	14.2	18.5	17.5

Table 8- Baseball Gloves/Mitts: % of Consumer Expense by Age Group

Item	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Male (48.9% of U.S. Pop.)	79.4	79.0	77.6	80.3	78.0	81.2	76.5	75.9	69.2	71.3	77.1

Table 9- Baseball Gloves/Mitts: % of Consumer Expense by Gender

3.8 PERFORMANCE CRITERIA

Designers use a product Performance Criteria to create a guide that lists the overall

goals for the design process. This guide will also be compared with the evaluation

checklist toward the end of the design process. I use this chart to visually set up the

approach for the best possible solution. I will demonstrate how this guide works by

displaying the chart which was used for this documentation. First is a summary outline

for a Performance Criteria followed by the real chart.
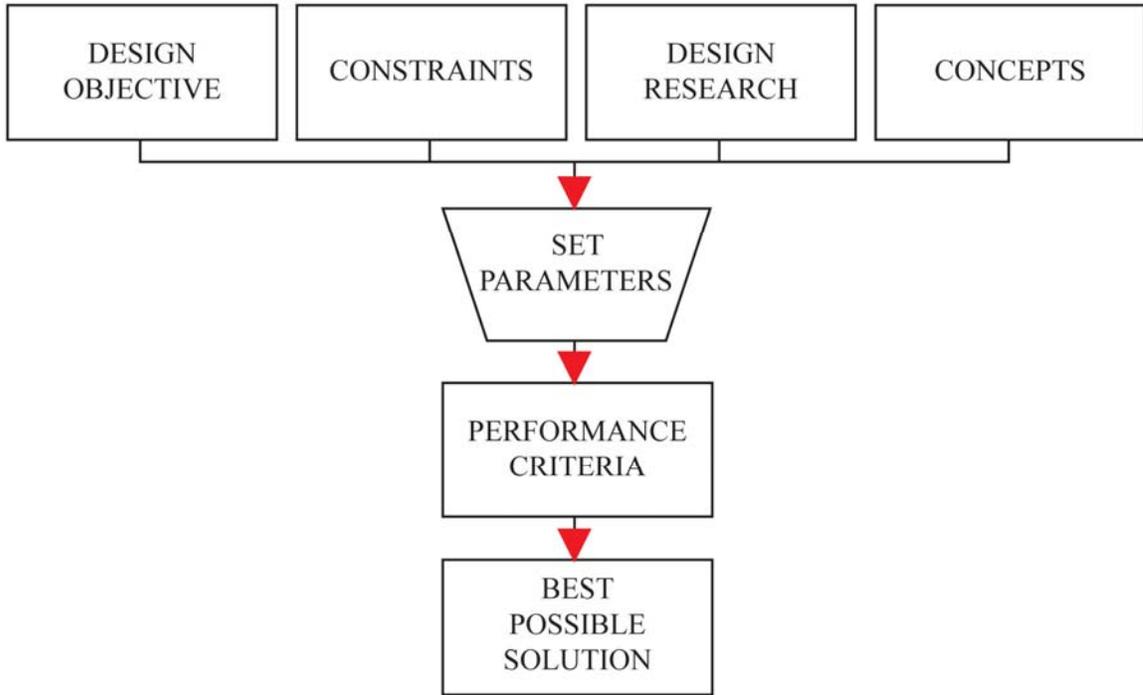
Table 10- Performance Criteria: Understanding the Components

- **Design Objective:** overall goal

- **Constraints:** identify basic limitations

- **Design Research:** learning the product

- **Concepts:** the designer's ideas

- **Set Parameters:** create a set of measurable factors for the product

- **Performance Criteria:** within the parameters set up the basic requirements of a

  good product

PERFORMANCE CRITERIA FOR YOUTH BASEBALL GLOVE

		PARAMETERS	PERFORMANCE CRITERIA
HUMAN PERFORMANCE	SOCIAL ECONOMIC	Retail price	Price range of $20 - $30
		Age range	Ages ranging from 8 to 10
		Sport	Youth baseball
		Activity level	All ranges of activity
	CULTURAL AESTHETIC	Style	Closed webbing
		Color of glove	Any natural color of leather
	PRACTIAL PHYSIOLOGICAL	Weight	Less than 3 pounds
		Length	Less than 12 inches
		Ease of operation	Understandable interface
TECHNICAL PERFORMANCE	DIRECT TECHNICAL	Type of position	Any fielding position
		Pocket size	Extended size
		Wrist adjustment	Any type of adjusting devise
		Instructional features	Ball guide
	INDIRECT TECHNICAL	Hand interface	Use anthropometry and human factors
		Safety	Must meet sport's governing bodies specifications
		Environment resistant	Moister, heat, dirt, and cold resistant
PRODUCTION PERFORMANCE	PLANNING	Distribution	Sporting goods stores
		Packaging	Self packaging
	MANUFACTURING	Material	Leather and foam padding
		Assembly	Hand assembled

Table 11- Performance Criteria: Project

3.9   INTERACTION OF THE PRODUCT

Now that the design importance has been established, I look at how the product will be produced in its final version.   The reason for looking ahead is to determine which parts interact with other parts. The more understanding the designer has of this, the more complete the final concept will be. This will optimize manufacturing and assembly.

3.9.1   Interaction Matrix

I used what is known as the Interaction Matrix to determine this data. The Matrix helps decide what parts need to interact more or less with other parts and aids in the planning of part placement. This chart usually lists parts vertically top to bottom on the left side and horizontally left to right across the top. For those who have never used this method, make sure that the order stays the same both vertically and horizontally.

PARTS	(1)	(2)	(3)	(4)	(5)	TOTALS
(1) BACKING		0	0	0	2	2
(2) PADDING	0		2	0	1	3
(3) POCKET	0	2		2	0	4
(4) WEB	0	0	2		0	2
(5) WRIST ADJUSTMENT	2	1	0	0		3

Table 12- Interaction Matrix: Baseball Glove Parts

3.9.2   Interaction Table

The Interaction Table is used like the Matrix with the exception that it involves the user and the environment instead of the product interaction with itself. The Table helps determine what parts the user interacts with and how the environment interacts with

the product's parts. It is setup slightly different from the Matrix. The parts of the

product are listed down the left side while the user parts are listed across the top.

PARTS	ENVIRONMENTAL ELEMENTS						HUMAN ELEMENTS				
	RAIN/WATER	SUN/LIGHT	TEMPERTURE	DUST/DIRT	HUMIDITY	SCORE	HAND	HEAD	MOUTH	BODY	SCORE
BACKING	2	2	2	2	2	10	2	0	0	1	3
PADDING	1	0	2	0	2	5	2	0	0	0	2
POCKET	1	1	2	1	2	7	1	1	0	1	3
WEB	2	2	2	2	2	10	0	1	1	1	3
WRIST ADJUSTMENT	2	2	2	1	2	9	2	0	1	1	4

Table 13- Interaction Table: Baseball Glove

3.10 MIND-MAPPING

Mapping the thought process visually offers better results than planning in a linear

way. You can take a single word and have numerous links attaching it to other ideas and

concepts. I worked with my committee chair, Sang-Gyeun Ahn, to create a mapping of

what this product needed. We found that to create a better product for young athletes the

product needs to communicate with the child. This is where the phrase 'interaction

communication' was developed. The following figure displays the mapping system in

use.
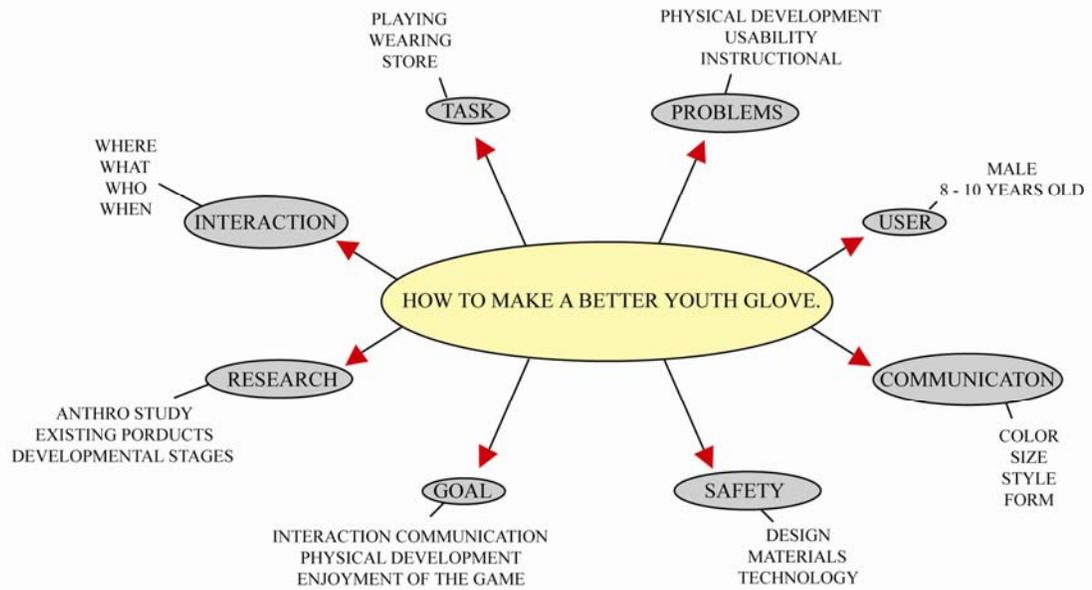
Figure 23- Mind Mapping: Creation of a Better Youth Glove

3.11 BRAINSTORMING

To create a new and innovative product, you need to generate as many radical ideas to help break through normal thinking patterns. Ideas should deliberately be as broad and odd as possible. With such creativity developing at such a fast rate of speed, do not discard any thoughts because that idea can develop later within the process. Do not suspend any judgment like 'that won't work' or 'bad idea', within the session. This ensures that all creativity is spontaneous and will be evaluated later. I will explore new ideas with his chair to have the basis to start his design development.

3.12 COMPARATIVE PRODUCT CHART

The use of this chart will allow a designer to compare and analyze similar products that are currently on the market. The products can be broken down into key features that might influence the design of the new product. You have to try to find a wide range of information to insure that all brands are accounted for. The following chart will show various brands and models that will be in the target market.

BRANDS	PICTURES	PRICES	INFORMATION
Akadema		$80.00	The Akadema® AZR-95 Prodigy Series 11-in youth baseballfeatures a Grasp Clasp system to lock your hand in the glove to ensure proper catching mechanics. The AZR uses the same USA Steerhide leather pocket and web as the Akadema Professional Models do for durability and quality. Akadema utlizes special leather on the back of the glove to keep it light and easy to break in.
Easton		$50.00	The Easton® SYS11 Stealth youth series 11-in youth baseball glove utilizes an Ideal Fit™ system with an index finger channel the combines the flexibility and comfort of an open back glove, with the feel/control of a closed back glove. Z-Flex™ Technology integrates 2 elastic strips on each side of the heel to provide you with a soft and flexible design.
Louisville		$40.00	The Louisville® TPX1055H TPX Hoss Series 10.5-in youth glove is constructed with genuine steerhide leather for strength and durability and Slugger Touch finger linings to wick away perspiration for better comfort and control. It also features a strong "Checkmate" web and an closed back with a strap.
Mizuno		$45.00	The Mizuno® GPL1100 Prospect® Series 11-in youth baseball glove for ages 6 and up is crafted with durable leather and utilizes Power Close™ technology to provide easier catching. A finger lot offers more control and a Power Lock™ closure keeps the fit snug.
Rawlings		$35.00	The Rawlings® PP10P3 Player Preferred® Series Jeter 10.0-in youth baseball glove features a Jete graphic on the palm and includes a 3-finger Fastback® design to ensure you get a snug fit.
Wilson		$25.00	The Wilson® AMLB10 A350 Series 10-in youth baseball glove brings you a durable and versatile design with a soft vinyl construction and a single post web.

Table 14- Comparative Product Chart: Youth Gloves

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CHAPTER 4: DESIGN DEVELOPMENT

4.1 INTRODUCTION

This chapter will detail the exploration of concepts and explain the process of taking a concept to the final prototype. Each step will be explained and illustrated to document the approach taken. The method, style, and materials I employed were selected because of my knowledge and familiarity of them. If another designer wishes to follow my example, be aware that this method is not universal and can be modified to fit the designer's own comfort and abilities.

4.2 IDEA SKETCHING

Visual communication is a key component of any designer's abilities. Sketching allows the designer to illustrate his/her ideas. With all the research that has been done, you must be able to advocate an idea or a product will never be produced. You can display ideas that were conceived earlier and develop new ones through your sketches.

Now having a solid idea of what I want to design, I begin idea sketching. I use this free and loose style of sketching to capture the feel of the product and how it will be used, without taking large amounts of time on one idea. The more sketches I produce, the more ideas I generate. Noticeably, I have my own style of sketching and method

of delivering them. I use detail sketches and cartoonist style to deliver the ideas of the product.

I always choose to start with the point of interaction between the user and product. I try to understand how each will affect the other. With this project being a glove, I began by sketching the human hand to explore how it might function under the restraints of the product.

Figure 24- Sketching: Hand

Examining finger position and range of movement, I began to sketch different finger combinations that would fit the concept and allow a child better control and usability. These sketches were then used with the next phase of development.
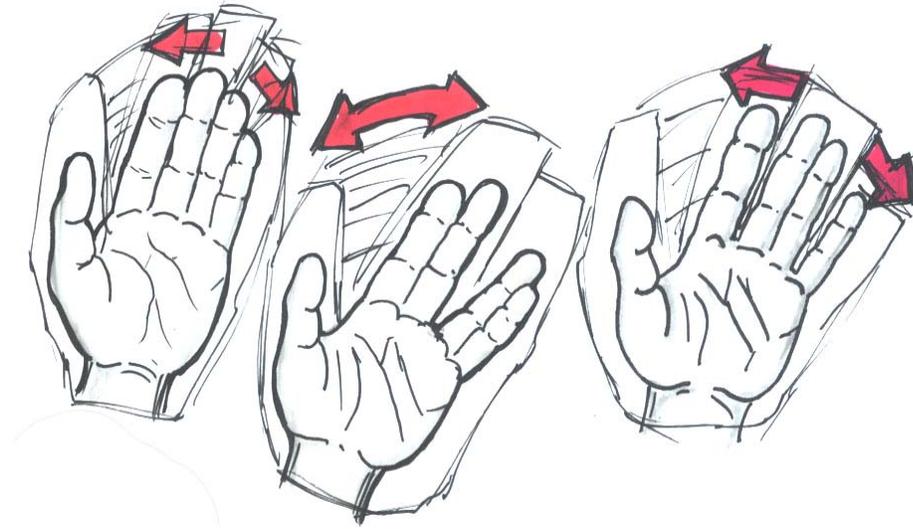
Figure 25- Sketching: Finger Location

4.3 FORM DEVELOPMENT

The concept sketches acted as a guide in building the concept into a product. The process began by preparing several alternative design models to study form, volume, ergonomics and kinematics. After the model has been examined, the next step will involve refining the concept models.
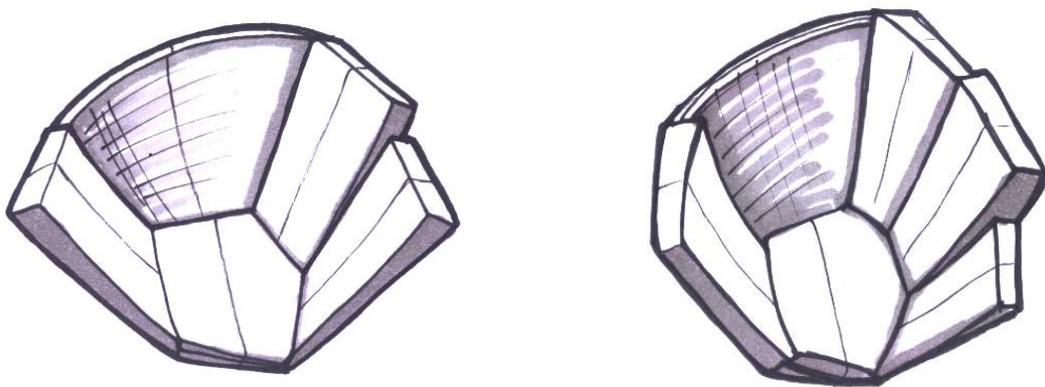
Figure 26- Sketching: Form Development

Figure 27- Form Models

4.4 DESIGN ALTERNATIVES

The next phase involves building a full scale model to demonstrate form, ergonomics, color, and details. The models will then be analyzed, tested, and evaluated according to the required performance criteria. The designer will determine if the solution functions as intended. With this knowledge, the hypothesis can be adjusted as necessary.

I chose the three-finger concept because it offers more advantages for the child. Pairing the fingers together gives the child extra closing strength. Having only three finger placements, the pocket of the glove can be larger. A larger pocket has more surface area, aiding the user in catching the baseball. This is a unique solution through design that strays from the traditional five-finger glove.

A designer should never restrict him/herself by not exploring strange and unique ways for a product to work or look. I have found that once I explore how a product functions, I must consider the restraints and criteria of the project.
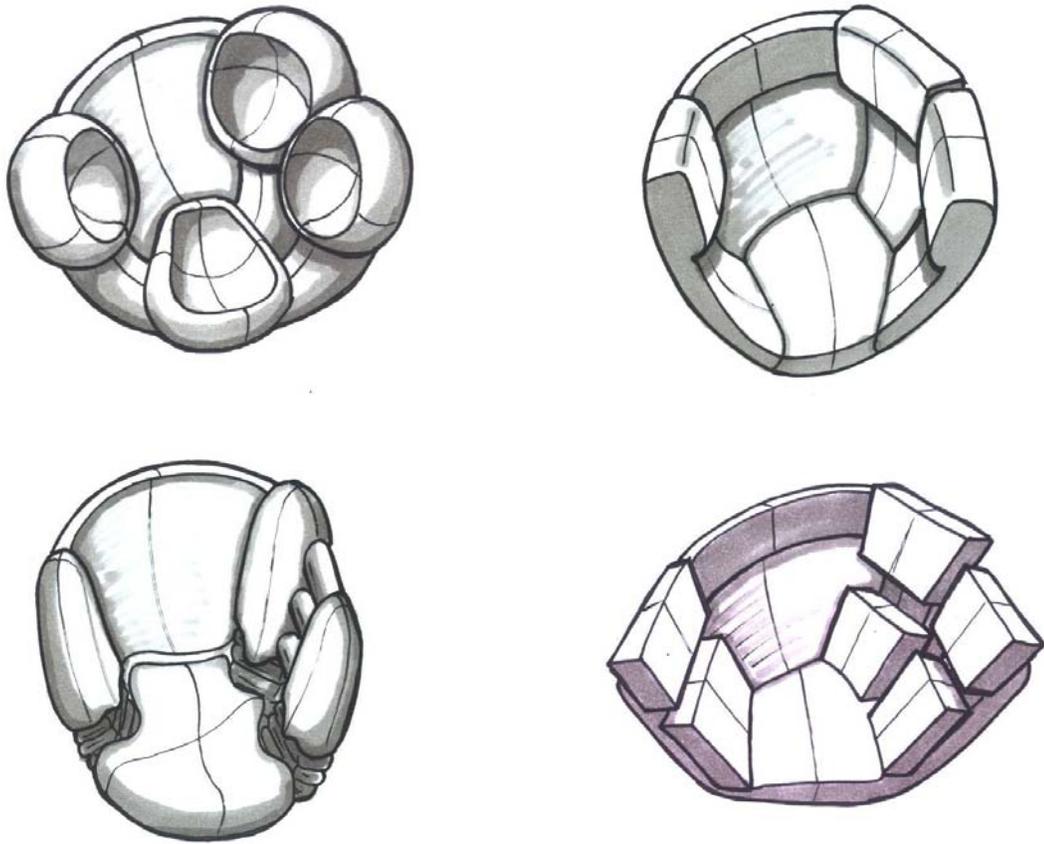
Figure 28- Sketching: Design Alternatives

Figure 29- Full Scale Model

Figure 30- Full Scale Model

4.5 PROTOTYPE

After the evaluations, you take the best aspects of all concepts and combine them into an effective solution. The designer can build the next model with 3D modeling software or by building a full-scale model. This model will consist of more detail and refinement. You can also build model fragments if necessary to test variations.

By sketching your test ideas, you will save valuable time and materials. Here the interaction communication of the glove had to be thought out. Trying various combinations, I was able to choose one that would work for the glove.
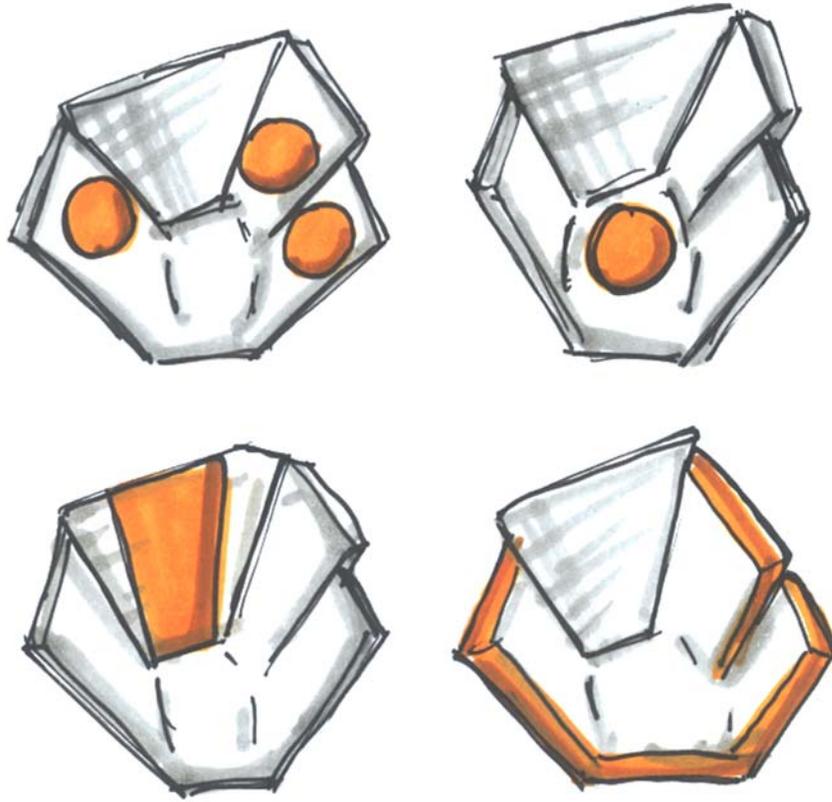
Figure 31- Sketching: Interaction Communication

Continuing to develop the concept within the sketching phase, action drawings allow the designer to see how the product would function in a real world setting. The following illustrations show how the user interacts with the glove and ball. Showing how to catch a fly ball, field a ground ball, and receive a throw from another player, the drawings are the first set in the actual field test of the final product. They act as an idea check to ensure the designer planned out and executed the design.
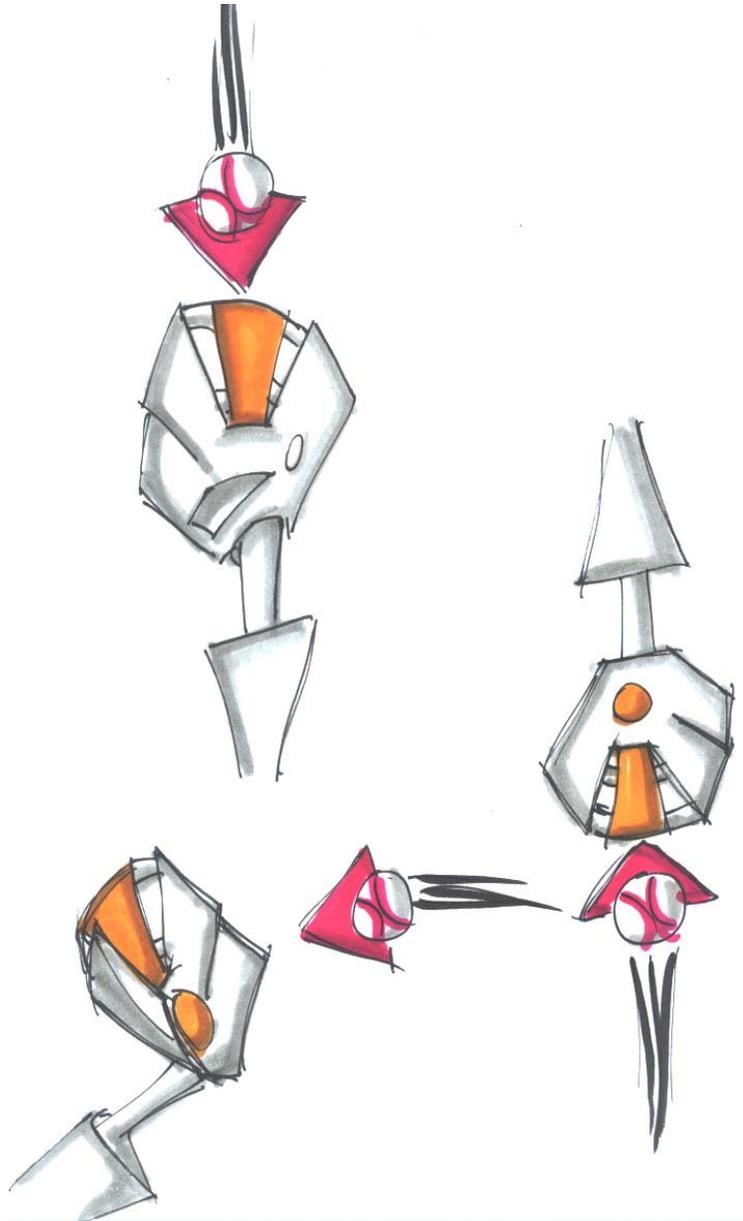
Figure 32- Sketching: Action Drawings

Now that most of the details have been worked out, you can do minor adjustments within the design before the product goes to production. Things such as graphics and accessories are a major focus now. Before going to the manufacturing of the glove technical drawings are needed to produce the measurements for the product. This is the

moment that after all the work is the most rewarding for the designer. After all of the

details have been finished, the final model is now ready for production. The designer is

able to see a product from start to finish.
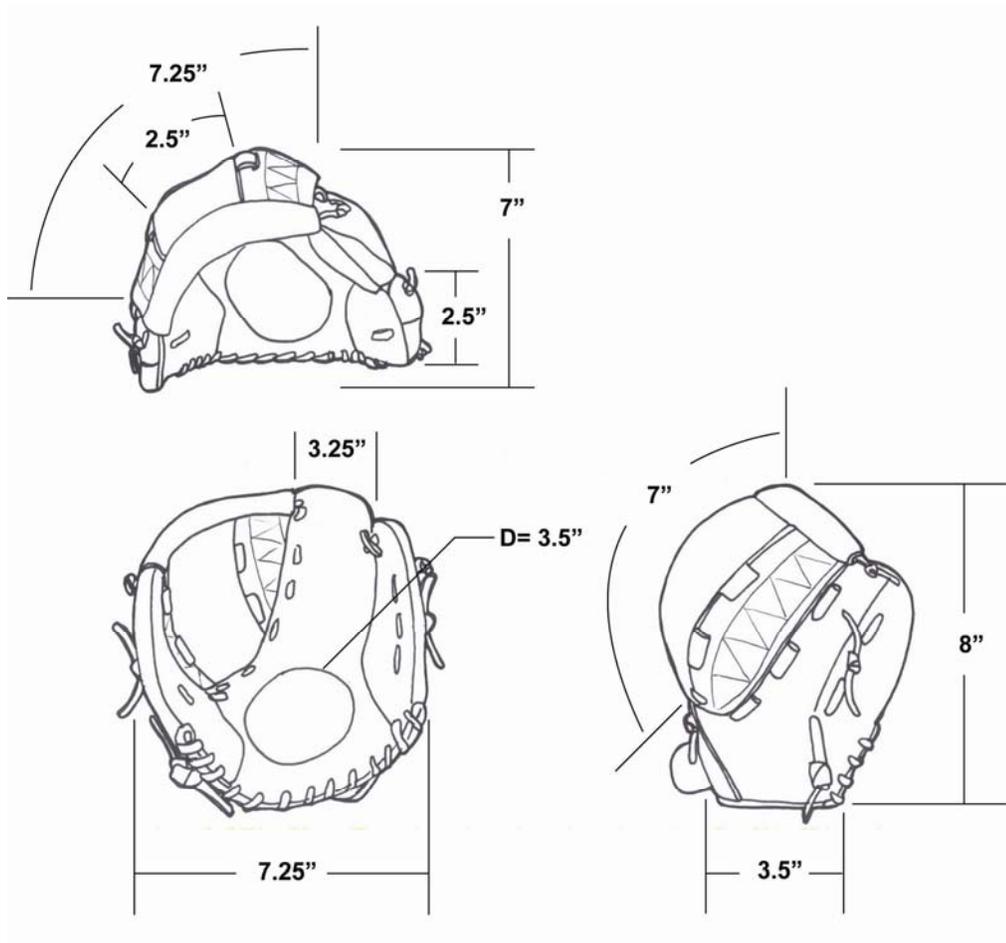
Figure 33- Technical Drawings

Figure 34- Concept Rendering

4.6 MANUFACTURING THE PRODUCT

With the design complete and the measurements determined, it is time for the construction of the product. Every product differs in how it is manufactured. Consider all methods that are currently used in the market. They will show the better method of assembly.

The glove making process begins with creating paper patterns of each component of the glove, taken from the prototype. From here, the production department hand-cuts the templates and makes necessary corrections to the design. At this point, steel clicker dies are made from the different templates.

Meanwhile, tanned hides are inspected for color and quality. The raw materials for each of the four components of the glove, the outside shell, padding, lining and the web, are separated for the production process. The shell and web travel in one direction, while the lining and padding move in another, only to meet later in the process.

Each section calls for a separate die, which is laid out on the leather hide. Then a large clicker machine, exerting hammer force to the dies, stamps out the pieces used to make the glove. The next operation is to stamp the leather hides with the trademarks of the manufacturer along with such things as the player's name, stock number and any other pertinent information.

The shell, which is comprised of three distinct parts: the fingers, the palm, and the thumb, is assembled by sewing the shell back and the palm pieces together. It is also interesting to note that these parts are stitched together inside-out. Afterwards, the glove is inspected for flaws, turned right side out and formed for proper shape and fit.

At the same time, the lining fingers are sewn together, joining the back and the palm. Although it would appear that the lining is wrong side out, it is in the proper position to be inserted into the shell. In a separate operation, the web is sewn and made ready for glove assembly.

Now it's time for the padding to be inserted into the lining for the final binding and lacing. All binding material is made with durable rawhide leather laces. After some fitting and shaping procedures, the glove is finished and ready for one last inspection.

4.7 THE GLOVE PROJECT

With this project, I was unable to follow industry procedures in the making of my prototype. Equipment, facilities, and money were restricting elements that led me to look for alternative solutions. Examining the old craft of hand-made glove construction, it seemed to be the best choice. The following is a step by step process that, taken as a guide, can be used in the manufacturing of a prototype. When choosing method of construction for a project, make sure to look at all possibilities. What works for one project might not be the best solution for another.

4.7.1   The Work Area

Before beginning construction of any project, you must find an area that can accommodate the work at hand. It does not matter whether it is a workshop, office, or just a desk in the corner of a room, the area is essential for creating the project. Things your workspace must have are space, good lighting, solid work surface, and comfort for the designer. The area will also need to be able to store the product so that it will not be disturbed when the designer is not working on it.

Figure 35- Work Area: Work Bench

Figure 36- Work Area: Sewing Bench

4.7.2 Materials

Prototypes can be constructed using various materials; often the choice has to do with personal preference. With this project, I wanted to use materials that had the child's strengths and weaknesses in mind. The material needs to withstand abuse and be very durable. Leather was chosen for its properties and the popularity of use within the glove industry.

Figure 37- Material: Leather

Figure 38- Material: Existing Product Materials

4.7.3 Tools

As with any craft, choosing the proper tools is very important. If you do not have the right tool for the job, the job will suffer either in craftsmanship or time. I found leatherworking to be no different. Depending on the material and how it is used, the tools should be selected to fit the project. This is not saying that different people will use different tools and achieve the same goals.

Figure 39- Tools: Hand Tools

Figure 40- Tools: Sewing Machine

4.7.4   Construction of the Prototype

With the design concept finalized and the tools chosen, the prototype can be

constructed. By using the drawings as guides and the size predetermined, the first thing

is to start forming the intended structure of the product. No matter the project you must

execute the basic form to achieve your goal of the prototype. Even with this project not

having a strong engineering need, be sure that all components are sound in the structural

support and mechanics.

Figure 41- Construction: Finger Structure Removed

Figure 42- Construction: Finger Padding Modifications

Figure 43- Construction: Making of the Pattern

Figure 44- Construction: Structure Support

New designs tend to have some element of innovation. This project targeted the interaction communication of the glove with the user. In this design, there are two areas in which the child and glove have an interaction between being used as a learning tool and a piece of equipment. One being a padded circle located in the palm of the glove and the other being the webbing itself. Orange inserts were chosen because of its high visibility and contrast to the other colors in the environment.

Figure 45- Construction: Center Target

First, we shall examine the padded center circle. This feature will have two purposes; to provide extra padding and to act as a visual target. Children, in the early stages of learning baseball, have the tendency to shy away from the ball for many reasons. One reason is because the ball travels at a high velocity and the glove is all the child has to protect them from injury. Most players, one time or another, have caught the ball with the palm of the glove and not the webbing. The child will experience a quick

sting in his/her hand. In order to eliminate some of the discomfort, an extra bit of

padding was added to the center. The padding is orange so it can double as a visual

target.

This target, when extended, will act as a "bull's eye" for the other players. This

interaction is used by multiple players at once. By offering a target, the other players

have a better idea of where to throw the ball. From a coaching point of view, the bright

target is visible from across the field and the coach will instantly know if the child is in

the proper position for fielding the ball.

Figure 46- Construction: Webbing Interaction

One of the most important aspects of the design is the webbing interaction. The

design called for the webbing of the glove to communicate with child to help align the

ball when fielding. The interaction was achieved by adding two strips, one on each side

of the webbing. Like the target, the orange webbing is highly visible for the player and

the coach, so it becomes a learning tool for the children.

Figure 47- Construction: Final Assembly

Figure 48- Construction: Final Assembly

4.8 FIELD TEST

After the glove was fully assembled, it was field tested. I enlisted my nephew, John Daniel Grissom, to help with the test. John Daniel happened to be in the focus group of this study, male age of eight years old. He has limited experience with baseball, so that will help as he used the glove without prior knowledge. The test consisted of catching the ball, visual aids, ground balls, fly balls, and durability. The following figures will illustrate the tests as they were preformed.

4.8.1   The Fit

Figure 49- Testing of the Glove: Fitting the Child

Figure 50- Testing of the Glove: Fitting the Child

The first test was to see if the glove actually fit the user. Using existing market standards, the size of the glove was still right for the user. We found the modifications did not hamper the function of the glove. Even though the looks of the glove had changed, he still felt comfortable using it.

4.8.2 Ground Balls

Figure 51- Testing of the Glove: Ground Balls

Wet now moved to the ground ball test. Not explaining the glove's interaction inserts to the user, I allowed him to figure the use of them by himself. After a few test grounders, the user promptly asked "Are the strips to line the ball up with?" With that question, the test was successful. It seemed that the user started to use the interaction guides and found them to be very helpful, which in turn made him want to continue with the test. He found himself having fun while learning.

Figure 52- Testing of the Glove: Ground Balls

4.8.3 Fly Balls
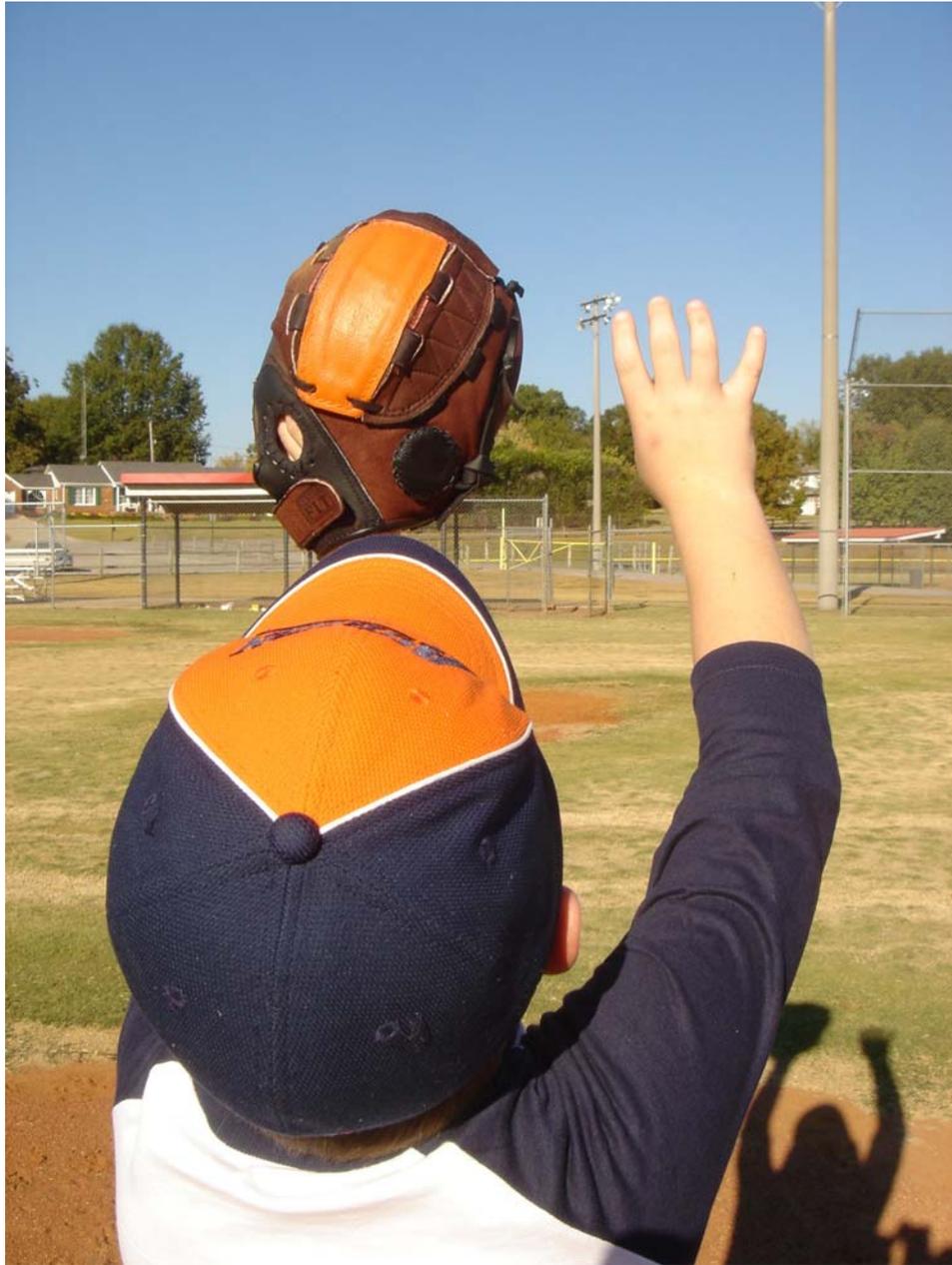
Figure 53- Testing of the Glove: Fly Balls

Having the user try to catch a fly ball proved to be the most challenging. Children

tend to misjudge the ball for many different reasons. Some are scared, some are at

different developmental stages, and some lack the knowledge of how to play the game to name a few. The user fell into the categories of being a little timid of the ball and not knowing how to actually catch a fly ball. So we proceeded slowly to make sure that the user would feel more confident in his skills. The user, like in the ground ball test, figured that the colored interaction insert was there for him to use. After catching a few balls, I asked if the insert useful and why it was useful. The user like the bright coloration of the insert and found it to stand out against the sky. It allowed him to see just enough of the insert and still be able to keep his eye on the ball. He said it was easy to understand that the ball should line up with the strip. He learned that if he used the insert as a tool the ball would not miss the glove and hit him. Test results were great.

Figure 54- Testing of the Glove: Fly Balls

4.8.4 Usability and Durability

Figure 55- Testing of the Glove: Usability and Durability

Now for the last test, the user would rate the usability and durability of the glove. Once his confidence was built up following the other test, he now became very playful. We began to throw the ball around and let him do whatever he felt was needed to complete this test. After about 30 minutes of playing, throwing, diving, and absolute abuse of the glove, he turned to me and stated "This is a pretty tough glove." Seeing that

the glove was still intact, I felt that the durability of the product seemed to hold up. So I

thanked him for his time and concluded the test.

Figure 56- Testing of the Glove: Usability and Durability

CHAPTER 5: CONCLUSIONS

5.1 SUMMARY OF THE STUDY

Chapter one sets the foundation on which this documentation is based. After stating the needs for this study, I outlined the goals that needed to be in place and the method by which I could achieve them. Anticipated outcomes were placed so that I could refer back to check my progress.

Chapter two describes the design factors of the project. Attention was given to the methodology of the design process. Each step was explained in detail so that you could understand without prior knowledge of design methodology. The tools that can be used to evaluate a design were also discussed in hopes that the designer could view his/her own design objectively. Initial research for this project was brought to your attention to have a basic understanding of what was needed to develop the final product for the current market.

Chapter three describes the research in more depth and narrows it down for precision. It discussed the overall development of children within the focus group. A brief acknowledgement of injuries in youth sports was discussed. Color, playing a large role in design, was studied to see how it might be used to enhance the design. An effort was made to show the market value of the product and why it should be developed.

I then started to break down the different aspects of the product and set criteria. The information obtained from research was applied to the development of ideas.

Chapter four documents the actual development of the product from an instructional setting. By using text and photographs to illustrate each step, you can easily understand the approach and process. The process describes tool selection, materials, and work areas that you will need to start and finish the product. After the product was finished, a field test was conducted and documented to show how the approach worked for the designer.

5.2 RECOMMENDATIONS FOR OTHERS

Due to lack of equipment design in youth sports, I believe that others can use this documentation as a guide. I have laid the groundwork for developing a process to design for children; however, it will ultimately be up to the individual designer to incorporate his/her own methodology in their approach. The same could also be said for the fabrication process used in this product.

Taking this into consideration, an in-depth market study is necessary for the development of any product due to ever-changing technology. Future trends can then be identified and predicted. However, trends change rapidly and can be rendered obsolete the moment it is published. Incorporating a survey to help understand the user and the market is important. However, be aware that surveys produce opinions and not always facts.

If needed, the approach used in this documentation can be expanded to cover more details about the distribution of completed products, as well as consumer's needs.

Some of the topics deemed unimportant for this project could be valuable to another designer in their product's needs. Also, different techniques of development could be explored.

5.3 SYNOPSIS

The approach used in this documentation was successful in two distinct ways. First, the text can be used as a guide to develop a product for the young athlete. Second, the information within the documentation gives you a chance to understand the approach of design, no matter the product.

Even with the topics highlighted in the previous section, it was a struggle to narrow down the information as it applies to this documentation. Much of the information, while relevant and worthy of investigation, did not apply to the main focus of this product. To this extent, my goal was to focus on the subject without becoming entangled in unnecessary information. I hope that you will leave with the knowledge and understanding necessary to execute your own approach, and with the desire to further explore the subject.

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APPENDICES

APPENDIX A

Gantt chart for this documentation.
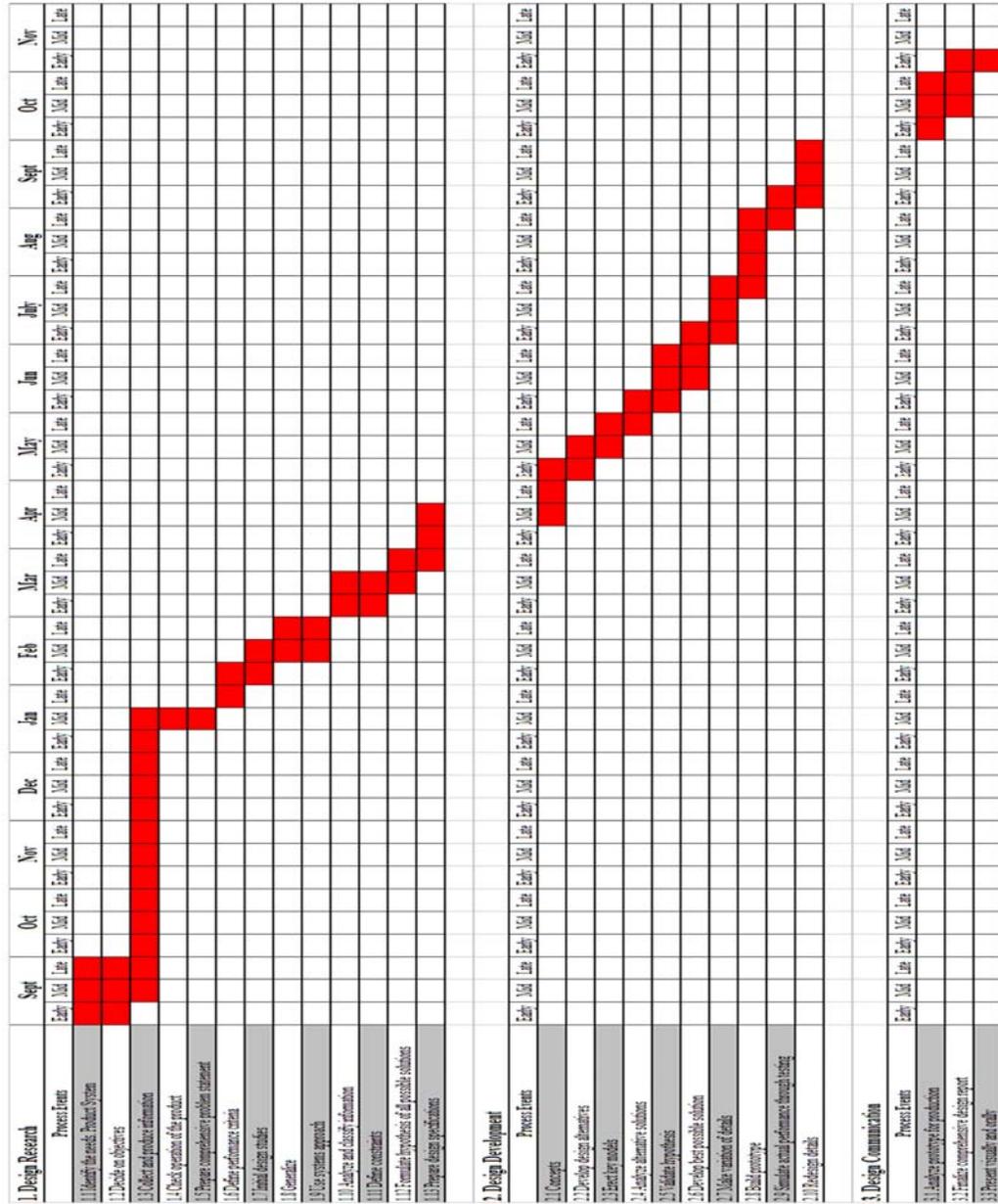
APPENDIX B

Baseball Gloves/Mitts: % of Consumer Expense by Household Income

Item	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Under $15,000 (17.0% of U.S. Pop.)	16.1	5.8	8.8	5.9	8.3	3.7	4.2	4.1	6.6	1.5	3.4
$15,000 - $24,999 (13.2% of U.S. Pop.)	14.2	12.1	13.1	9.3	9.6	7.2	8.9	7.7	6.7	11.1	6.6
$25,000 - $34,999 (13.4% of U.S. Pop.)	14.8	14.0	15.1	15.1	12.2	9.5	8.9	10.4	9.2	5.0	11.2
$35,000 - $49,999 (16.0% of U.S. Pop.)	12.4	21.6	22.6	24.0	20.9	21.4	21.9	14.7	16.1	16.3	14.0
$50,000 - $74,999 (19.0% of U.S. Pop.)	23.9	29.4	23.1	33.6	32.2	40.2	29.4	29.3	3.0	26.7	17.2
$75,000 - $99,999 (11.8% of U.S. Pop.)	18.6*	17.1*	17.3*	12.1*	16.8*	18.0*	26.7*	18.5	12.5	18.8	18.8
$100,000+ (9.6% of U.S. Pop.)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	15.3	18.9	20.6	28.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Base (dollars in mil.)	171.3	155.6	120.6	146.1	150.2	149.8	169.9	162.5	161.6	152.5	155.4

APPENDIX C

Baseball Gloves/Mitts: % of Consumer Exp. by Outlet Type

Item	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Sporting Goods Stores	49.3	42.1	43.0	49.6	47.2	62.8	59.7	57.1	49.3	56.4	53.0
Specialty Sport Shops	7.4	11.5	8.9	6.8	11.1	3.7	1.5	11.1	9.2	10.5	9.6
Pro Shops	---	0.5	0.5	0.2	0.7	0.9	0.3	0.3	1.6	1.2	---
Discount Stores	31.8	29.6	38.0	29.6	29.0	25.8	23.4	26.0	29.5	29.1	32.7
Warehouse Clubs	1.5	1.0	1.5	2.5	1.0	0.7	0.5	0.5	0.7	---	0.5
Department Stores	3.8	4.6	3.4	4.4	4.0	2.6	4.4	1.3	1.6	0.4	0.4
Mail Order	0.4	3.1	1.5	2.6	3.2	0.8	8.6	1.4	1.4	---	1.8
Catalog Showrooms	1.1	1.5	0.2	0.9	1.5	---	n/a	n/a	n/a	n/a	n/a
Online/Internet	n/a	n/a	n/a	n/a	n/a	n/a	---	0.2	2.2	1.6	1.4
Other Outlets	4.7	6.1	3.0	3.4	2.3	2.7	1.6	2.1	4.5	0.8	0.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Base ($ in mil.)	171.3	155.6	120.6	146.1	150.2	149.8	169.9	162.5	161.6	152.5	155.4

APPENDIX D

Baseball Gloves/Mitts: % of Consumer Unit Purchases by Brand

Item	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Wilson	33.5	35.2	33.2	33.3	31.6	33.2	37.8	35.3	34.9	34.7	39.3
Rawlings	32.4	29.9	30.5	33.3	33.9	29.6	26.1	28.9	36.6	26.6	27.9
Mizuno	3.8	3.0	5.0	4.0	3.5	6.1	5.8	3.8	5.4	13.4	8.7
Spalding	10.4	14.3	10.4	9.8	13.6	11.1	12.0	11.1	6.5	4.8	5.5
MacGregor	3.8	3.3	3.4	2.4	2.2	2.1	0.8	1.7	3.2	1.1	4.5
Nike	---	---	---	---	---	1.1	---	2.6	3.8	6.5	4.2
Easton	0.9	0.8	1.0	1.5	3.2	1.1	3.3	3.4	1.6	1.5	1.4
Voit	---	---	---	---	---	---	---	---	---	---	0.9
Louisville Slugger	2.3	3.0	4.7	3.1	3.2	3.2	2.9	1.3	1.6	1.2	0.8
Franklin	4.6	2.5	3.7	4.3	3.8	5.7	4.1	3.8	3.2	2.9	---
Retail House Brand	---	---	---	---	---	---	---	0.9	---	0.8	---
Nocona	---	0.8	---	0.6	0.9	1.1	---	1.7	---	---	---
Regent	2.3	1.9	4.0	1.5	---	---	---	0.9	---	---	---
Dunlop	---	1.6	---	0.6	---	---	---	0.9	---	---	---
Worth	---	---	---	---	0.6	---	---	---	---	---	---
Base (units in mil.)	4.9	4.2	3.7	4.3	4.5	4.5	4.6	4.6	4.5	4.4	4.5

APPENDIX E

Baseball Gloves/Mitts: % of Consumer Unit Purchases by Outlet Type

Item	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Sporting Goods Stores	36.2	31.5	33.6	38.4	36.8	44.9	47.6	44.2	38.3	43.6	42.5
Specialty Sport Shops	5.9	7.1	5.7	4.5	7.1	3.4	1.6	7.5	5.9	8.2	7.4
Pro Shops	---	0.3	0.7	0.3	0.6	0.4	0.4	0.4	1.0	1.7	---
Discount Stores	42.3	41.6	48.6	43.1	41.9	39.0	38.4	41.7	44.5	42.9	44.7
Warehouse Clubs	1.8	1.4	1.7	2.8	1.0	0.8	0.8	0.4	0.6	---	0.5
Department Stores	4.7	6.5	4.7	5.3	5.5	3.7	5.6	2.1	2.1	0.7	0.3
Mail Order	0.3	1.4	0.7	1.1	1.6	0.7	3.2	0.4	0.7	---	2.8
Catalog Showrooms	1.2	1.1	0.3	1.4	1.0	---	n/a	n/a	n/a	n/a	n/a
Online/Internet	n/a	n/a	n/a	n/a	n/a	n/a	---	0.4	0.6	1.3	1.0
Other Outlets	7.6	9.1	4.0	3.1	4.5	7.1	2.4	2.9	6.3	1.6	0.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Base (units in mil.)	4.9	4.2	3.7	4.3	4.5	4.5	4.6	4.6	4.5	4.4	4.5

APPENDIX F

Baseball Gloves/Mitts: % of Consumer Unit Purchases by Price Point

Item	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Under $20	27.5	29.2	31.3	28.9	30.6	28.4	27.1	29.6	26.1	28.0	22.7
$20 to $29	19.0	18.3	23.1	24.0	21.6	26.7	23.1	20.5	21.4	22.4	25.3
$30 to $39	17.8	16.4	18.6	16.4	16.8	13.1	15.1	16.8	15.7	13.8	19.3
$40 to $59	35.7*	36.0*	27.0*	30.6*	31.1*	14.6	15.9	17.7	19.6	17.0	17.7
$60 & Over	n/a	n/a	n/a	n/a	n/a	17.3	18.8	15.4	17.1	17.7	15.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Base (units in mil.)	4.9	4.2	3.7	4.3	4.5	4.5	4.6	4.6	4.5	4.4	4.5
Average Price ($)	36.79	35.19	32.63	34.28	33.24	33.04	37.29	35.36	35.64	34.81	34.69
* $40 & Over											