Product Design and Development of the
Easy-Fit Triathlon Racing Shoe

by

Chi-An Wang

Submitted to the Department of Mechanical
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of the Requirements for the
Degree of

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ABSTRACT

Triathlon is one of the fastest growing sports in the world. The swim-bike-run competition has opened a whole new market in the industry of athletic footwear. In a triathlon, athletes need to make fast transitions from the swim to the bike, then from the bike to the run. Therefore, there is a demand for a triathlon running shoe that is easy and quick to slip on. In this project, the upper portion of a new racing shoe is developed, called the Easy-Fit Triathlon Shoe. It is specially designed with an incredible ease of entry to minimize transition time. A worldwide survey was conducted, and it was found that racing shoe performance features, such as being lightweight and having adequate cushioning, are extremely important to the elite competitive triathlete. Therefore, these features were also integrated into the design of the Easy-Fit Triathlon Shoe. The innovative tongue and heel system expand the shoe opening then tighten the entire shoe efficiently. Collaborative work was done with New Balance, and a prototype was built.

Thesis Supervisor: Dr. Kim B. Blair

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TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Background – The Triathlon

The multi-sport event called triathlon consists of three portions: swim, bike, and run. From short distances to grueling long distances, the new attraction has hooked thousands of people across the world, and spread like a heat wave throughout the United States. It was not until September of 1974 that the San Diego Track Club initiated this event as an open competition. The first Ironman race, notorious for filling its entries with crazed masochistic athletes, was held in January of 1977. A year later, only twelve men finished the Ironman race, as opposed to the 1500 men and women in the past few years. Since its initiation, numerous triathlon organizations have been established all over the world, including USA Triathlon in 1982, and the International Triathlon Union (ITU) in 1989. Just last fall in September of 2000, triathlon debuted as an Olympic sport, where the women's event was the first medal awarded at the 2000 Olympic Games in Sydney, Australia.

Triathlons have increased tremendously in popularity in the past decade, as physical fitness has become a high priority in the modern adult. It seems that no challenge is too great for the calloused athletic mind. Even the marathon is almost too easy. As the caliber of the athletes has toughened, so has the race. Hence, the swim-bike-run triathlon was born. Currently, there are about eight standard distances of triathlons, but they can be summarized in the following four types:

Sprint – 0.5-mile swim, 12-mile bike, 3-mile run
Olympic – 0.9-mile swim, 24.9-mile bike, 6.2-mile run
Half Ironman – 1.2-mile swim, 56-mile bike, 13.1-mile run
Ironman – 2.4-mile swim, 112-mile bike, 26.2-mile run

There has even been the recent creation of the Double Ironman (two Ironman races back to back), the Hyperman (three Ironman races back to back), and the Deca-triathlon (ten times the Ironman, which takes about 18 days). Only endurance adepts run these longer races, and they are unofficial.

Nevertheless, the competition in the standard races has skyrocketed, and each year more technological products are introduced to the market to give elite athletes a competitive advantage over their opponents. Between each of the events of the triathlon, there is the transition, where the athletes must change their gear or footwear in as short a time as possible. In the heat of the race, by the time athletes are ending the bike portion, their physical alertness is no longer at its peak. Their bodies have already undergone the swim and bike ride, and particularly for the longer distances, this may total up to about six continuous hours of strenuous physical exertion. As they ride into the transition area, their feet are already out of their biking cleats. After pedaling the last hundred meters barefoot, the athletes must jog up to their running equipment while undoing the straps on their bike helmets, and prepare for the run. Sweat dripping down their bodies, and eyesight hazy, they most likely do not have the hand coordination of a normal unexhausted person. During this transition, athletes may spend undesired extra time fumbling to put on their running shoes. Most of them do not even want to sacrifice the seconds in order to put on socks as well, particularly when their feet are wet from the sweat on their bodies and water that they hose themselves with to keep cool. Therefore, the market quickly emerged for comfortable running shoes that require very little time to put on and tighten, and most of all are simple to use.

1.2 The Motivation

In the industry of running shoes, market analysis comprises an enormous portion of the product development process. Unfortunately, no two feet are the same. Particularly in athletic footwear, product designs must vary enough to satisfy as many customers as possible, yet they must have similar manufacturability so as not to drain the resources of the company. While more customers are willing to pay greater amounts of money for shoes that fit them properly, the expectations for the shoes to protect them from injuries are also much higher. In the case of triathlons, the easiest solution was to take a normal successful running shoe and to change the shoe-tightening aspect of it, in particular the laces. These universal changes could be applied to any shoe, allowing flexibility in the user.

However, a completely untapped area for market potential is in the triathlon racing shoe, an innovative running shoe that retains all the comfort and high performance of the original running shoe, yet is designed for the needs of a competitive triathlete. Some of these needs may be easy-fit technology, lightweight features, and good enough comfort and fit to be worn without socks. The latter two are generally very saturated areas, where extensive research has already been and is currently being done. The easy-fit technology, on the other hand, has enormous room for further creativity and new product launches. Therefore, major shoe companies are investing in the development of a triathlon shoe product that allows the quick-fit and minimized transition time as much as possible yet performs as a high-quality racing shoe.

2.0 MARKET RESEARCH

2.1 Current Market in Athletic Footwear

Not more than a decade ago, trendy brand names and styles led the success of the footwear industry. Running shoes only comprised about 8 percent of the $13 billion athletic footwear market in 1996. The shoe companies that boasted of the highest total annual sales were generally those that invested relatively heavily in marketing tactics, such as Nike and Reebok. Athletic icons, from Michael Jordan to Mia Hamm, were seen everywhere wearing a particular brand of shoe to enforce the latest trend. However, as everyday athletes started setting higher personal expectations or goals to break old records, their awareness and education in footwear performance have increased likewise. The more recent trend has shifted toward the technical, high quality direction, as customers are becoming more educated in their choice of athletic shoes. As of 1996, athletic footwear companies spent an average estimate of 10 percent of sales on marketing, which amounts to approximately $800 million. This is still notably higher than the average 4 percent of sales spent on marketing for non-athletic footwear.

Nevertheless, companies that put emphasis on technical research and high quality saw a significant rise in their total annual sales, for example, New Balance. Ranked fourth in total sales in the nation's top athletic footwear brands by the Sporting Goods Intelligence and the Competitive Media Reporting, New Balance projected a 77.4 percent increase in U.S. sales from 1999 to 2000. Nike, Reebok, and Adidas, the more marketing-oriented companies, have observed plateaus in their annual total sales in the past year. With the market for a triathlon shoe wide open, the contest to develop a comfortable, long-distance, easy-fit triathlon racing shoe begins.

2.2 Existing Quick-Fit Methods

In the recent years that the triathlon competition has become more of a nail-biter, athletes have been using all sorts of different methods to help decrease their transition time between the bike and the run portions. One of the most common methods is to use elastic shoelaces, rather than the usual non-stretch cotton laces. The elastic laces allow runners to tie their shoes to proper fit before the race, and at the transition, the stretchiness allows them to slide their feet in relatively quickly. Conveniently, this method can apply on all types of shoes, and elastic laces are very inexpensive and easy to acquire. However, like most materials held in tension for long periods of time, the elasticity decreases and sometimes, the runner may find that the laces need to be retied. If this were to occur in the middle of a race, significant time would be lost again, thus defeating the purpose of the elastic laces in the first place.

Another common method is to use lace locks, small clips that can hold the regular shoelaces in place. There are multiple names for these devices, but the manner in which to use them is generally the same. By pressing the clip, the lace lock can slide along the shoelace, holding it in a tighter position as desired. These are advantageous, because the shoelaces then do not need to be tied at all. Just by sliding the lace lock tighter after inserting their foot, runners can adjust the fit on each shoe easily. While this method is more secure during the race than the elastic laces, it does take a little more time, because the athlete must first tighten all the laces before locking them down. Although a seemingly simple task, tightening laces in the middle of a race that is several hours long can be extremely agitating.

Many athletes find that the best way to minimize time is to simply slide on their racing shoe that is pre-tied with regular non-elastic shoelaces. This way, the shoe stays fit to their foot for the entire run portion, and there are no locks to fumble with. In order to facilitate this process of sliding a wet foot into a pre-tightened shoe, runners often coat the inside of each shoe heel with a generous layer of Vaseline. The greasy jelly cream minimizes the friction between the skin and the shoe material, allowing the athlete to be on his or her way as quickly as possible. Even though the first several steps are quite slippery inside the shoe, the Vaseline does eventually rub away. However, this process repeated over a couple races or more eventually ruins the inner lining, forcing the runner to replace the shoe more often than otherwise necessary.

Finally, athletes also use some other miscellaneous methods that are somewhat less common, such as a combination of the tactics discussed above. Other runners may powder their feet to minimize friction while putting on their running shoe, but this also presents the same problem as the Vaseline of ruining the shoe. Some athletes are willing to sacrifice pedaling power by wearing the same shoes for the bike the run portions. Unfortunately, this solution only changes the transition of concern to the one between the swim and the bike. All in all, the quick, efficient transition is important enough to a competitive triathlete that they oftentimes practice their transitions as part of the preparation for the race.

2.3 Competitive Companies and Products

Currently, the first major athletic footwear company to break into the triathlon shoe market is Nike. Last year, Nike launched the Presto campaign, flashing a multitude of bright colors and oddly shaped uppers. The Presto line includes a variety of shoes, all with the universal concept of easy-fit, whether for running or game sports. The Presto Cage, for example, is advertised as "slip it on, and head to the court in comfort," retailed at $70. Other than the easy-fit feature and its trendy appearance, the shoe has little or no other performance advantage as a basketball shoe. Another Presto shoe, the Air Visi Havoc exhibits an unattached heel, carrying the slogan "cause some commotion with this slip-on mix of style and sport." This shoe sells for $70.

Probably the most popular and most successful shoe out of this Presto line is the Air Kukini. The Kukini sells at a retail price of $90, which is on the high side of the average customer's spending range. The shoe is advertised as a "fast-in, fast-out training shoe, inspired by the quick-change need of triathletes." Even the cool shades and water-like colors that appear on the upper mesh and the plastic material remind consumers of the coast of Hawaii, where the World Champion Ironman race begins. Unlike the basketball shoes, the Kukini actually fulfills a necessary purpose of having an easy-fit running shoe. The shoe upper is made of a mesh material, mixed with some elastic webbing near the edge of the tongue. Encasing most of the shoe and providing the structure is a semi-elastic plastic web that protects the front of the foot and supports the back of the heel. Due to the elasticity of the plastic and the underlying mesh, runners can easily open the shoe and slide their foot in. The entire shoe is tightened by tugging on the plastic web loop behind the heel, which is unfortunately, a bit difficult to grasp. While fairly successful as a training shoe, it still lacks the racing aspect because of its heavy weight due to the plastic.

Other than the Nike Presto shoes, there are no other major competitors in this field. The sport is so new and rapidly growing in participants that companies are racing to grab their share of the market demand. One of these companies is New Balance, where most of the product planning for this project was done.

3.0 IDENTIFYING THE CUSTOMER

3.1 Triathlon Survey

In order to gather raw-data from customers to understand the most up-to-date competitive triathlete, a survey (shown in Appendix A) was set up and sent out to the several triathlon clubs in the Northeast area through mail, electronic mail, and the Internet. Some of the groups that were reached included the following:

- Team Psycho (New England, 60 members, extended mailing list over 100)
- Bay State Triathlon Team (New England, over 100 members)
- Wheelworks Triathlon Team (New England, 60 members)
- MIT Triathlon Club (60 members)
- Purdue University Triathlon Club (Indiana, size unsure)
- The rec.sport.triathlon Newsgroup (worldwide)
- New Balance Triathlon Team (worldwide)

New England has the third largest community of athletes seriously training for a triathlon, following San Diego, California, and Boulder, Colorado. San Diego is ideal for its climate, and Boulder provides effective training because of its altitude. New England, on the other hand, has the most versatile climate, and the harsh winters actually prevent athletes from over-training. Nevertheless, the triathlon survey reached athletes from all over the country, and some from all over the world. The survey sought to understand three major aspects about the triathlon consumer: the user profile, their average annual spending, and their priorities regarding the racing shoe performance features. The user profile was helpful in defining the customer in terms of age, size, and training level and habits. The financial portion of the survey provided a sound range that customers are willing to pay for a pair of good racing shoes. The third section was the most insightful and sharpened the focus of the actual design aspect of the shoe, by revealing which features are most important to the users.

3.2 Data Analysis

A total of 161 responses were received and studied in detail. The data was tabulated on Microsoft Works and Excel in order for percentage rankings to be charted. All of the survey responses were forwarded to chian@mit.edu and blairk@mit.edu. Complete numerical data can be provided upon request. All open responses, such as comments and questions, have been condensed to the selected few for maintaining the focus of the project.

3.2.1 User Profile

It was found that over 50% of survey respondents fall within the age group of 26-35 years old, as illustrated in Figure 1. These are generally young to middle-aged adults who find triathlon racing as a recreational, yet challenging way of staying healthy and fit during their prime time. Since the race is a balanced combination of three sports, training becomes more manageable and easier to schedule around less flexible work hours. The next largest age group is the 25-and-under, making up 24% of the population of responses. These athletes are mostly college students or recent graduates who are

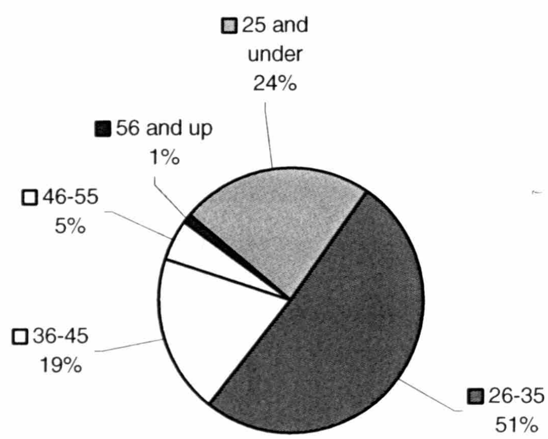


Figure 1. Age Group Distribution

relatively new to the sport, yet possess the ambition to accomplish exciting goals. Some of the more experienced triathletes fall into the 19% third largest group, 36-45 years old. Others in that group started competing in triathlons at a relatively older age, since it was not a widely popular sport back in their teens. Finally, 6% make up the rest of the triathletes of 46 years or older. The total participants are comprised of 30% females and 70% males.

The weight distribution of the athletes is useful information, because when designing a shoe, it is important to understand the average size of the athlete in question. Most of the triathletes are also road racers or marathoners. Therefore, the amount of cushioning provided in the shoe sole depends much on the weight distribution of the runners. Out of the individuals who responded to the survey, the weight of the athletes ranged from 100-240 lbs., as shown in Figure 2 below. The total average weight was around 160 lbs. However, as apparent on the graph, there are two mild peaks in the distribution, contributed by the fact the subjects include both men and women. On average, the female mean weight was about 125 lbs., and the male mean weight was about 165 lbs. These numbers show that triathletes are on the relatively small size, which is consistent with the fact that most runners are small and light.

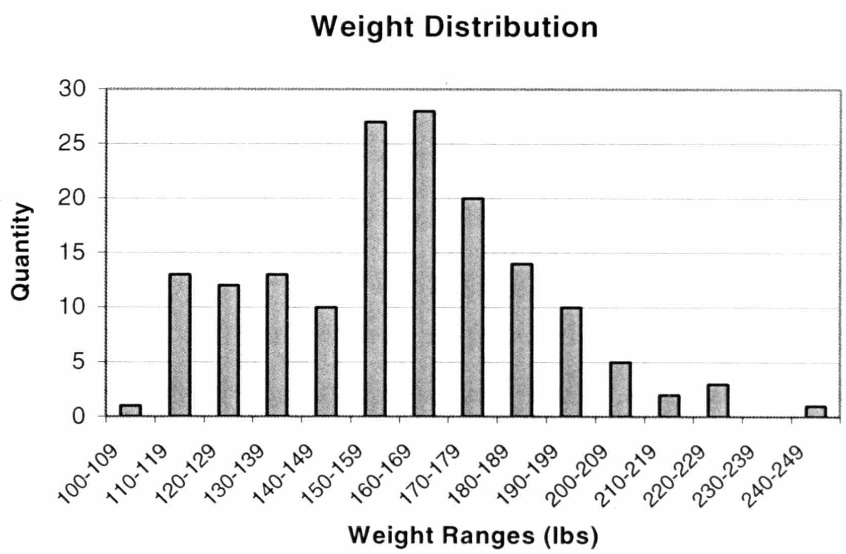


Figure 2. Weight distribution chart

The number of hours a person trains per week and the number of races competed per year are both valuable measures to understand how serious that person is in the sport. People who train fewer than five hours a week are generally individuals who simply enjoy working out every once in a while to stay healthy. Runners who train six to ten hours per week are more committed to the successful performance of their races, but recreation and social diversity is what drives them. They are probably a part of a training club in their area. If a training schedule takes up eleven to fifteen hours of the week, the person is probably more competitive than recreational, and thus more likely to invest in gear or equipment that will give them that extra edge over their opponents. He or she may be a part of an official team. People who train over sixteen hours per week are most likely professional triathletes who are sponsored by their team, and whose careers are involved in racing and improving for competition. From the survey responses received, the distribution was as follows in Figure 3. Most triathletes train six to ten hours a week, but a close second is the eleven to fifteen hour per week training group.

Percentage of Triathletes	Training hours per week
4%	Fewer than 5
42%	6-10
37%	11-15
17%	More than 16

Figure 3. Training hours table.

Likewise, triathletes who compete in one or two races per year are recreational athletes or just beginners. Those who race three to five triathlons annually are more competitive, and thus more aware of ways to improve their performance steadily from race to race. Serious triathletes who compete in more than five races per year may do short as well as long distances. These individuals are most willing to invest in higher quality running shoes or swimming and biking gear. As shown below in Figure 4, the distribution for this inquiry shows that most triathletes compete in more than five races per year. An important observation is that a large percentage of athletes compete in large number of races. Therefore, there is a greater need for appropriate triathlon racing shoes.

Percentage of Triathletes	Number of races competed annually
12%	1-2
34%	3-5
55%	More than 5

Figure 4. Annual races table.

This result is expected, because the survey was sent to triathlon clubs, most of whose members are serious enough in the sport to be a part of such organizations.

3.2.2 Financial Analysis

In order to get an understanding of the triathlon consumer, it was necessary to know how often shoe purchases are made and how much is spent annually. As shown in Figure 5, the target customer for triathlon equipment spends mostly between $500-$1000 per year on sportsgoods. However, most of this is spent on bicycle equipment, which is much pricier than the average running gear. An 83% majority of the athletes buy a new pair of running shoes every few months, averaging out to 3 new pairs per year. Apparently, 68% of these purchases fell within the range of $70-$100 per pair.

Annual Expenditure on Sportsgoods	6% 29% 35% 30%	Less than $250 $250-$500 $500-$1000 More than $1000
Frequency of Shoe Purchases	7% 83% 9%	Weekly Monthly (includes every few months) Annually
Average Cost of Each Shoe Purchase	5% 20% 68% 8%	Less than $40 $40-$70 $70-$100 More than $100

Figure 5. Table of annual expenditure analysis.

These numbers are important in determining the necessities of the product and the manufacturing process. After the final target price has been properly estimated, the costs of the preliminary steps including prototyping and mass production can be adjusted to stay within budgetary limitations.

3.2.3 Performance Features

Depending on the distance of the race and the competitiveness of the athlete, runners may run in racing flats, lightweight training shoes, or regular running shoes. Racing flats are specially designed for reducing weight and material on the runner's feet, so that each step taken is as agile and efficient as possible. However, the shoe has very little cushioning and support. Therefore, for longer races that include more than six miles of running, flats may actually become tiresome and painful to wear. Lightweight training shoes look and feel like regular running shoes, but their sole cushioning is less dense. Therefore the shoe can handle fewer total miles, but for the purpose of racing, the lightweight quality is extremely advantageous. Finally, recreational participants oftentimes just race in the same shoes that they train in to keep their gear as simple as possible. Through the survey, it was found that 74% of the athletes wear different shoes to race at least part of the time, and over 30% said their racing shoe of choice is the lightweight trainer, because of its sufficient cushioning.

Another key metric was the racing shoe mileage expectancy, charted in Figure 6. More than 50% of the athletes said they expected their racing shoe to last 100-300 miles, which is about the range that lightweight training shoes fall under nicely. Racing flats generally log fewer than 100 miles before wearing out, and regular running shoes can usually handle more than 300 miles, depending on how well they are maintained.

Shoe Mileage Expectancy	12%	Fewer than 100
	52%	100-300
	34%	300-600
	2%	More than 600

Figure 6. Racing shoe mileage expectancy.

In the survey, athletes were asked to measure the importance of a fast transition between the different sections on a scale from 1 to 10, 1 being not important and 10 being very important. The importance of wearing socks was also a concern, because in order to prevent blisters on the runners' bare feet, the inside of the shoe must be seamless. Since socks, particularly wet socks, add extra weight, it was not surprising to find that many triathletes prefer not to wear socks at all during the race. Each of the distributions from 161 responses was charted, as shown in the following figures.

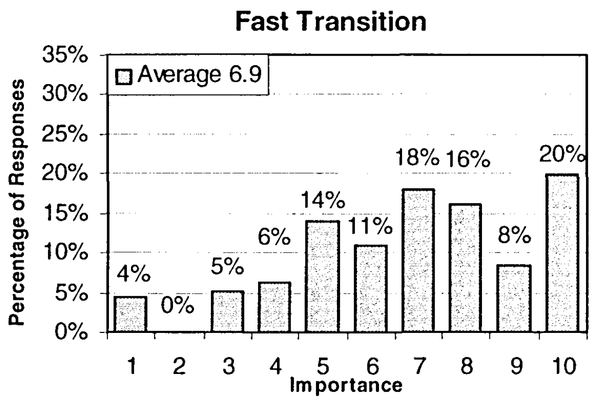


Figure 7. Transition

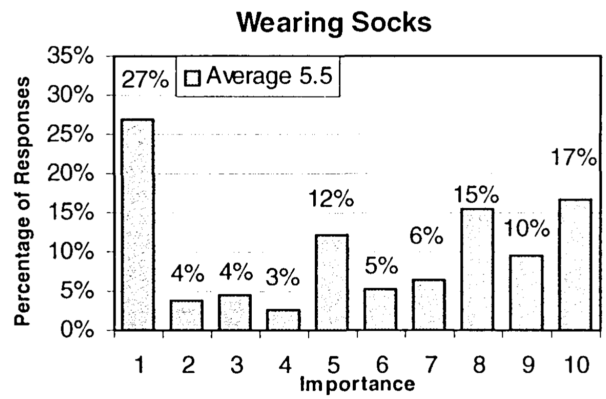


Figure 8. Socks

Over 60% of the athletes noted that a fast transition was important to the race strategy. During this time, the person who is most organized and most prepared with the gear is the person who makes the fastest transition. Having a running shoe that does not require complicated lacing or tightening features can significantly improve the efficiency of the athlete. Out of 10, the average measure of importance was 6.9. Nearly a third of the runners said they prefer not wearing socks at all, while others did not seem to show as strong a preference. The average for this was much lower at 5.5.

Athletes were also asked to measure the importance of seven racing shoe features,

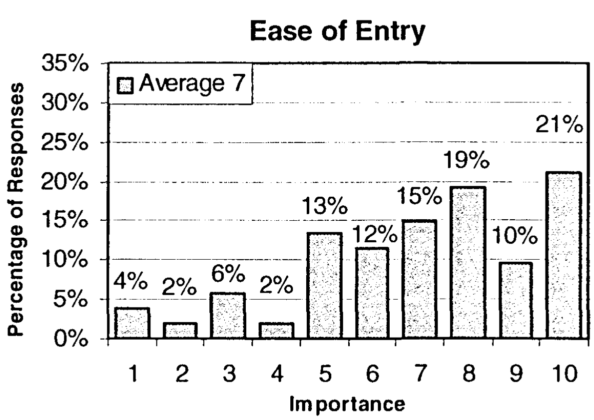


Figure 9. Ease of entry

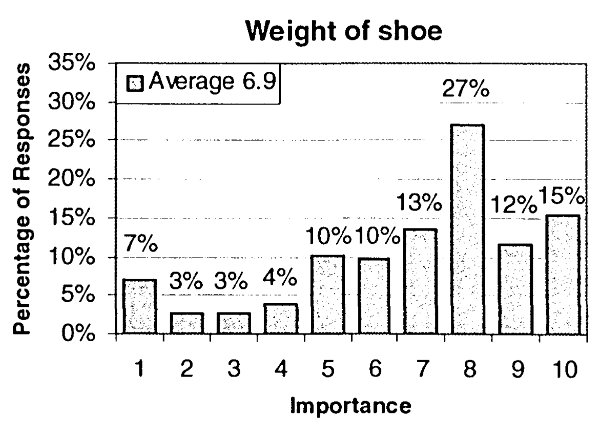


Figure 10. Weight

including the following: ease of entry, weight of shoe, breathability, cushioning, motion control, durability, and cleanability. In Figures 9 and 10, ease of entry was apparently a very high concern for most triathletes. The average response was a 7, and over 20% had rated it as a 10. The weight of shoe was also of high priority with an average of 6.9, and nearly 30% said it had an importance of 8.

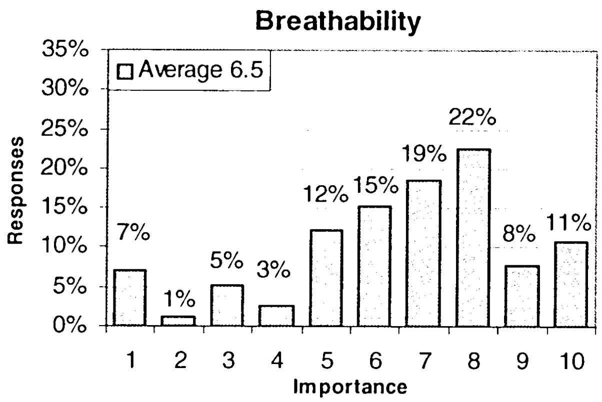


Figure 11. Breathability

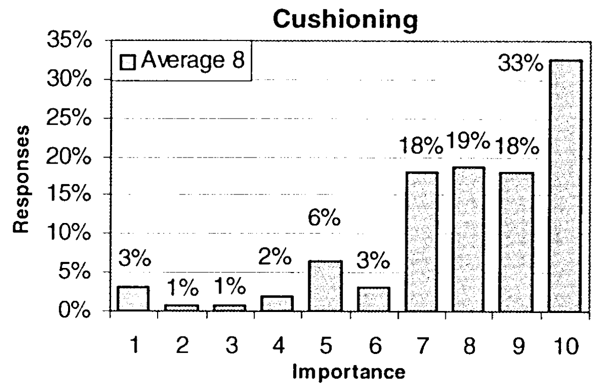


Figure 12. Cushioning

Breathability was a factor of lesser importance, but still averaging a 6.5, showing that customers find it valuable but not crucial. Cushioning on the other hand rated the highest out of all the features. While a racing shoe is meant to be fast and lightweight, it must also maintain the good support to prevent injuries due to frequent racing. This information again confirms that a lightweight racing shoe with adequate though not too dense cushioning may be the best solution to satisfy the most customers.

In Figures 13 and 14, motion control and durability are more evenly spread distributions. Motion control in particular has to do more with the biomechanics of the

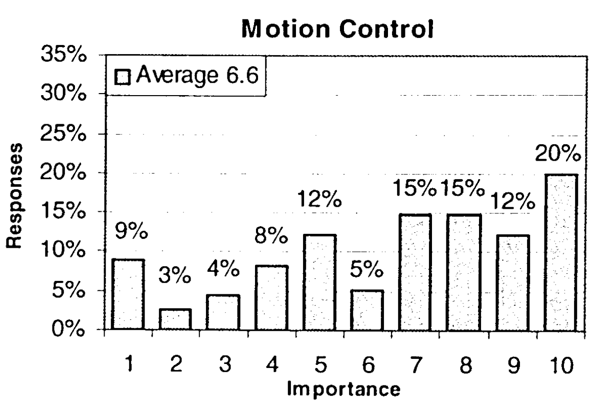


Figure 13. Motion Control

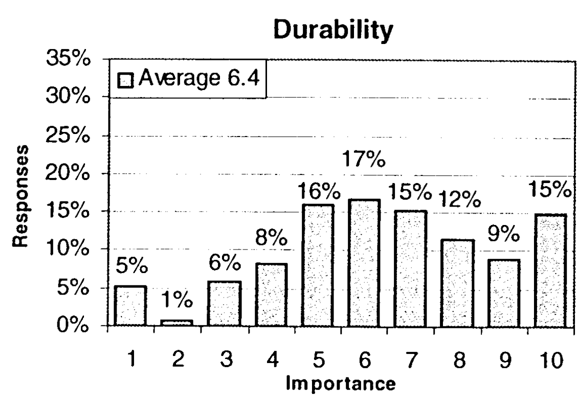


Figure 14. Durability

runners, and whether they pronate or not. The last feature on the survey was cleanability, which turned out to be the lowest priority of all, averaging a rating of 3.4. By the time a shoe is too dirty to wear, the other features of it are in need of replacement as well.

Once all the survey data was compiled, a good understanding of the customer needs was established. The next step was to generate a thorough concept of the Easy-Fit triathlon shoe.

4.0 NEW PRODUCT PLANNING

4.1 Concept Generation

The main feature of the Easy-Fit Triathlon shoe is the ease of entry its title claims. Observations were done on elite triathletes by watching videos of the 1995 and 1997 World Champion Ironman races held in Hawaii. Since the runners do not even take the time to sit down, the shoe must have easy-to-grip solutions to facilitate the process. Locations on the shoe of particular interest were the tongue and the heel, because those are the easiest places to grab while inserting one's foot into the shoe.

After discussions with New Balance representatives Sean Murphy and Edith Harmon, it was decided that the main concept generation would involve the upper section for a new lightweight racing shoe. Since many lower sections already exist, the area with most potential improvement was the upper. Weekly meetings were held to report the progress of the product development. In the early stages of the project, several brainstorming sessions were held to define multiple ways of tightening a shoe, ranging from the standard laces to unimaginable openings in bizarre locations. Ideas were bounced off of already existing products such as the Reebok Pump, the Nike Kukini, or the Puma Disc. Inspirations also came from products that are completely unrelated to running shoes, such as water-ski boots, snowboard bindings, and inline skates. Particular attachments or auxiliary pieces used an assortment of zippers, elastic bands, clips, buckles, Velcro straps, etc. The complete collection of brainstorm depictions can be found in Appendix B.

In addition to shoe related products, existing products with easy-grip parts and shapes and materials were also brainstormed and listed. Objects as simple as toothbrushes were compared next to the bottom outsole of rock-climbing shoes. This exercise was helpful in terms of varying the materials that might appear on the upper of the running shoe that would facilitate the handling of the shoe.

Some current New Balance products were also examined, since the actual prototyping would occur at their factory. The NBX-C, a lightweight form fitting racing shoe, was the model from which specifications for the Easy-Fit were derived. Different existing designs of the tongue and heel from multiple shoes were analyzed. The unattached heel was a feature of particular interest that would fit appropriately into the new shoe. New Balance also made suggestions regarding the bottom unit of the shoe. Finally, when the next step of concept selection was ready to be taken, a marketing brief draft was written to present the Easy-Fit shoe (Appendix C). This document adopted the format used in actual footwear industries for marketing groups to communicate the new product concept to the design engineers. The next step involved narrowing down the specifics of the shoe to be prepared for manufacturing.

4.2 Concept Selection

The Easy-Fit Triathlon shoe began developing a recognizable identity at the New Balance factory in Lawrence, Massachusetts. Meetings and discussions were held with Materials Manager Keith Wheeler and Pattern Engineer Gilbert Moreau to determine the specific materials and features of the shoe. As shown in Figure 15, specification drawings were done to be used in the making of the prototype. A material map and a color map were necessary to represent the shoe upper portions in its entirety. The majority of the Easy-Fit shoe is made of a mesh material, breathable and light. Designs include synthetic leather to provide structural support and embroidery to vary colors without adding weight. The heel of the shoe is a separate piece, aside from the elastic Gore piece connecting it to the rest of the shoe (not visible in the picture). This allows more flexibility in the user's ankles when sliding the foot in. However, a loose sheet of mesh also connects the heel to the back of the bottom unit to fit snuggly against the foot. A pull-tab sits on the back for the user to hold while lifting the tongue. On the tongue is a stretchy elastic web that continues below the surface of the mesh. A T-shaped tab at the top of the tongue allows the user to slip two fingers under the plastic to pull apart the shoe opening easily. Once the foot is inserted in the foot, one tug of the plastic web tightens the shoe all around. During the race, the runner need not tie anything or grab anything difficult to grip.

The colors chosen for the Easy-Fit shoe is HD56A Neon Blue for the synthetic leather and embroidery, Silver for the mesh, and HD38A Sunset Red for the New Balance logos. The plastic web will be white, clear or black. The shoe is light and flexible, yet has the longer-lasting cushioning of a lightweight training shoe, rather than a racing flat.

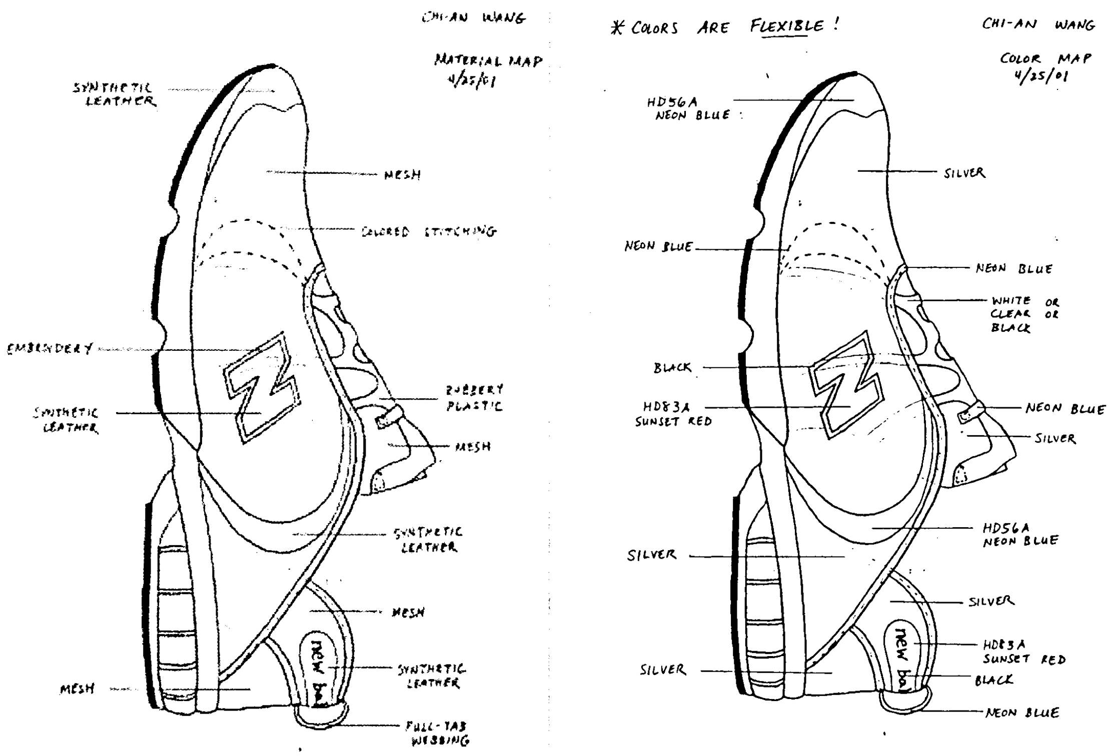


Figure 15. Material map and color map of the Easy-Fit Triathlon Shoe.

This model was prototyped at the New Balance factory. The SL1 lightweight bottom unit of the New Balance 1040 was adopted for the prototype.

5.0 CONCLUSION AND RECOMMENDATION

The complete prototype will be available in the near future, provided by the New Balance domestic and overseas factories. Following standard procedure, the shoe is made in a Men's size 9.5 and medium D width. As of May 11, 2001, the left upper component was finished with the exception of the plastic fit on the tongue. The liquid urethane did not cure as expected in the silicon mold made for the pattern, and therefore production of the plastic piece was delayed. As a back-up plan, a model maker will hand cut the urethane film, although this process does not ensure an exact fit with all the components because of the human error factor. Nevertheless, for the purpose of the prototype, slight inaccuracy can be permitted.

The plastic web on the tongue of the shoe requires further mechanical investigation in order to ensure the best design possible. Theoretically, the unattached heel secures the back of the foot, and the plastic web secures the forefoot. The contrast of the semi-stiff plastic and the soft mesh should allow an easy grip motion of the tongue. Nevertheless, perhaps the tongue needs to be shortened or attached to the upper in a more fastened place. Currently, there are also some seams along the inside of the shoe, and this may cause discomfort in runners who do not wear socks. The plastic web may need to be stretched down the outside of the upper mesh, rather than the inside, to solve that problem. In the future, materials can also be removed to make the shoe even lighter. For example, the piece of mesh that connects the heel to the back of the outsole can afford to be sacrificed, if the trend allows it. Customers may find the appearance too outrageous at first, until they have become more accustomed to the design.

Future work for this project includes testing the prototype for customer satisfaction. The Easy-Fit design of the tongue and heel system must be pleasing enough for the users that they would purchase this product over their favorite running shoe or the competitive Nike products. If the design of the plastic tab is not optimal for sliding fingers under, then the shape and length can be changed to improve the overall performance of the shoe. Currently, the design is still open for modifications while maintaining the same concept of tightening the shoe by a tug of the plastic web. Since the goal of this project is to allow the triathlete to slip on the shoe as quickly as possible, focus should remain on the upper portion of the shoe. While the written surveys were helpful in understanding the needs of the customer, an even more effective approach would be to send the shoe into the field and ask how athletes find their usability in a race. Perhaps the plastic web is still too clumsy to grip, or maybe the design is optimal and the heel piece needs a similar tab. Perhaps more material can be taken off to decrease the weight of the shoe even more. This kind of first-hand feedback not only clarifies the types of modifications that may improve the product tremendously, but also it can reveal unanticipated customer needs. The faster these needs are met by footwear companies, the faster the market potential will prove to be profitable. The Easy-Fit triathlon Shoe will be among these new products.

6.0 APPENDICES

6.1 Appendix A – Triathlon Survey

This survey appears at the website: http://web.mit.edu/chian/www/triathlon.html. It was distributed through mail, electronic mail, and the Internet. There were a total of 161 responses from all over the world. All responses were tallied.

Gender: Male __ Female __
Age group: 25 or under __ 26-35 __ 36-45 __ 46-55 __ 56-65 __ 66 or up __
Weight: _______ **Height:** ________ **Shoe size:** _______ **Shoe width:** _______
Hours that you train per week (including competitions):
Fewer than 5 __ 6-10__ 11-15 __ More than 16 __
How often you make sports-related purchases at retail stores:
Weekly __ Monthly __ Annually __ Other ________
How much you spend annually on sporting goods:
Less than $250 __ $250-$500 __ $500-$1000 __ More than $1000 __
Average number of pairs of running shoes you buy per year:
0-3 __ 4-6 __ More than 6 __
Average cost per pair of running shoes:
Less than $40 __ $40-$70 __ $70-$100 __ More than $100 __
How much would you be willing to pay for an "easy entry" triathlon running shoe? ____________
What triathlon distance do you compete in? Include all that apply.
Sprint __ Olympic __ Half Ironman __ Ironman __
How many years have you been competing in triathlons? ________
How many races per year do you compete in?
1-2 __ 3-5 __ More than 5 __
What is your main motivation for competing? E.g. recreational, professional, etc. ____________
What type of running shoe do you wear during a triathlon?
Racing flats __ Lightweight trainers __ Regular running shoes __ Other ___
Do you wear the same shoes for training and competition? Yes __ No __
How many miles do you expect your RACING shoe to last?
One race __ Less than 100 __ 100-300 __ 300-600 __ More than 600 __
How important is it to you to have a running shoe that minimizes transition time between the bike and run?
Not important Somewhat Important Very Important
1 2 3 4 5 6 7 8 9 10
How important is it to you to wear socks during the run?
Not important Somewhat Important Very Important
1 2 3 4 5 6 7 8 9 10
How important are the following performance features to you for a RACING shoe?
Ease of entry
Not important Somewhat Important Very Important
1 2 3 4 5 6 7 8 9 10
Weight of shoe
Not important Somewhat Important Very Important
1 2 3 4 5 6 7 8 9 10
Breathability
Not important Somewhat Important Very Important
1 2 3 4 5 6 7 8 9 10
Cushioning
Not important Somewhat Important Very Important
1 2 3 4 5 6 7 8 9 10

Motion Control

Not important			Somewhat Important					Very Important	
1	2	3	4	5	6	7	8	9	10

Durability

Not important			Somewhat Important					Very Important	
1	2	3	4	5	6	7	8	9	10

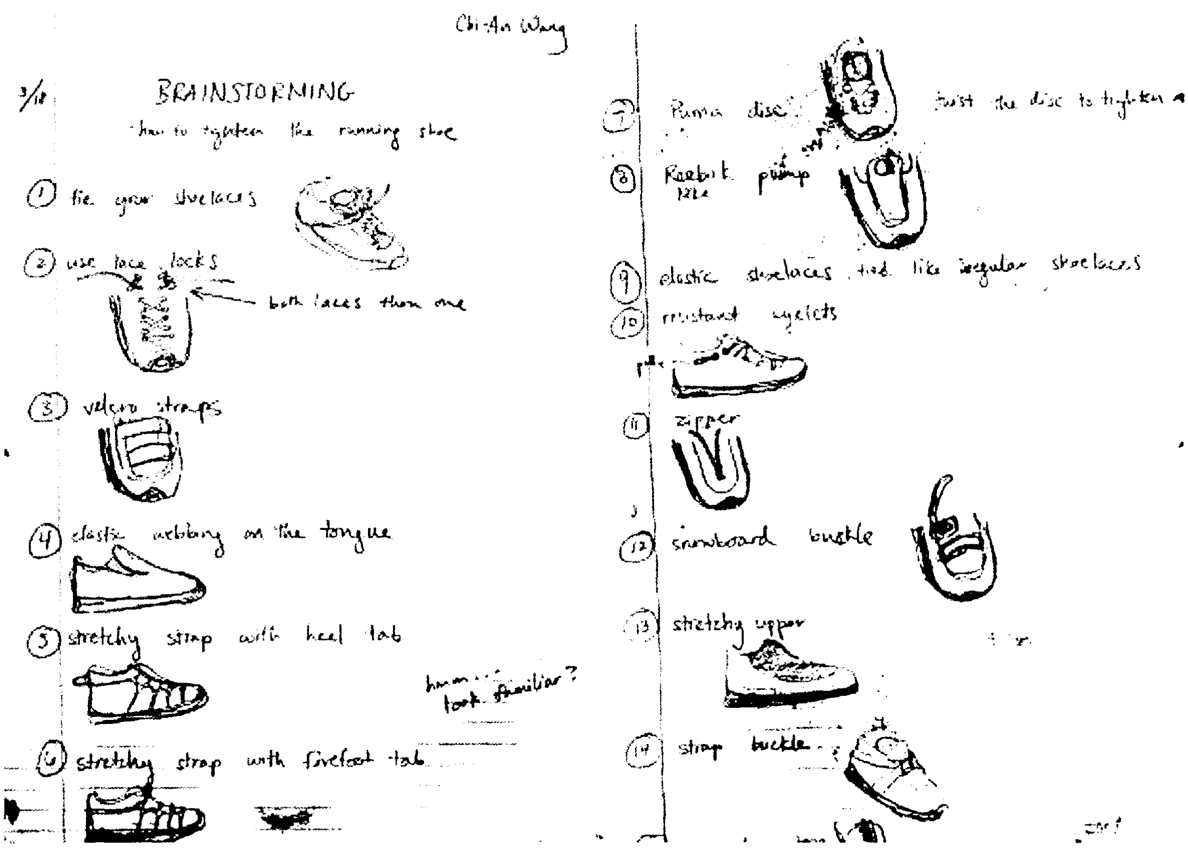
Cleanability/Washability

Not important			Somewhat Important					Very Important	
1	2	3	4	5	6	7	8	9	10

What are some of the key performance features you look for in a triathlon racing shoe?
What method(s) do you use to minimize transition time between the bike and run?
Any additional comments/suggestions:

6.2 Appendix B – Brainstorm Depictions

The following illustrations were made during the concept generation step of the project. Sketches facilitated the representation of shoe designs that were only partially developed.



2 1

(16) contacts when wet

only the part gets affected

when athlete pours water in shoe, it tightens around foot.

(17) Snap-on sole

an advantage ?

(18) pull side straps

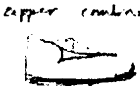
pull or push the ...

(19) knobby clips

the wrap ... of release button

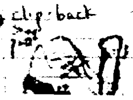
(20) snap fit — same as above, but with a snap button instead of a clip

(21) zipper combined w/ stretchy ankle sleeve



(22) drawstring shoe

(23) clip-back tongue



(24) remote control tightener - by clicking a button, a little pulley will tighten the shoe up to a preset pressure.

(25) bra-hooks (I'm getting desperate here)

(26) earring clips, studs

(27) lambourghini - upside down

closes the flaps
* click *

(28) envelope sticky when wet

(29) like those bags where unzipping broadens the inside space

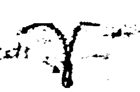
little zipper on both sides, with semi-elastic string attached at both ends of zipper.

OPEN THE HEEL ?
OTHER PLACES ?

GRIP TO

1. toothbrush handle (squishy)
2. palm of glove
3. steering wheel
4. bottom of sandal (knobby)
5. top surface of mousepad
6. bottom
7. remote control buttons
8. armrest of desk chair
9. foam soda can holders

10. escalator hand rail
11. hair brush handle
12. bicycle handles / scooter handles
13. brim of baseball cap
14. bicycle seat
15. biking gloves
16. rubbery letters on sweatshirts
17. bottom of rockclimbing shoes
18. string on swim goggles
19. tennis rackets
20. yard tools
21. pens & pencils (grip things)
22. baseball bats
23. luggage handles
24. knobby zipper things on jackets



25. camera buttons
26. coffee mugs/cups

27. kitchen mops/sponge mops handles
28. sobbing sunglasses
29. backpack straps
30. pliers, wrenches
31. hand-strengthener things
32. scissors

6.3 Appendix C – Marketing Brief

The following draft was written based on official industry documents, modified to suit the Easy-Fit Triathlon shoe.

Marketing Brief Draft

Concept Definition/Positioning Statement
An easy-entry lightweight trainer, most suitable for pavement running. Designed for minimizing transition time between bike and run in a triathlon. Suitable for mid to high mileage triathlon runners who have a neutral to mild pronation gait cycle.

Consumer Profile
Primary: 26-35, serious and recreational triathlon runner
Secondary: 25 and under, young energetic athlete and casual wearer

Competitive Models	Retail	F&B's
Nike Air Kukini (2000)	$90	Fast-in, fast-out; triathlete-inspired training wheel covers.
Nike Presto Cage (2000)	$70	The ultra-light meshlar textile with synthetic overlays easily slides on and off with a tug.
Nike Air Visi Havoc (2000)	$70	A slip-on cross trainer that incorporates various materials, including full-grain leather and stretch synthetics for durability and a comfortable fit.

Post Mortem Issues on Predecessor Style
Difficult to insert foot quickly

Cosmetic Direction
Look to develop concept boards that will aid in selling in the design concept.
<u>Overall:</u> Maintain lightweight quality of the shoe.
<u>Upper:</u> Brighter colors, must look fast.
    Easy grip material on tongue.
    Possible up-down zipper on heel.
<u>Sole Unit:</u> Sidewall visibility of stability web on both lateral and medial sides.

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