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Executive Summary

Kids II is an innovative infant gear design and manufacturing company that has positioned themselves as a primary stakeholder in this project through their sponsorship, prior key research, mentorship, and ample industry experience. Through the Georgia Tech ME/ ID studio, Kids II is taking steps to develop a product that tackles the problems current infant products fail to address. There is a hole in the market for products that ergonomically fit children during the first two years of their lives where they more than double in weight. Products that attempt to solve this need and are marketed to fit a wide range of children are usually poorly designed and in many cases fail to comfortably fit all of their intended users. As a result, parents turn to purchasing more products as a solution to constantly meet and grow with their child's developing needs. This creates more waste, money, and redundancy on the parents' end while also sacrificing any developmental and emotional investment created between the child and product. Because of this unmet need for one piece of adaptable infant gear, Kids II has given the Georgia Tech ME/ID team the challenge to develop the next generation infant-to-toddler rocker that will blow competition away by its visual communication of actual comfort and consistent ergonomic support for all stages of child development. A successful project will (1) provide a comfortable area of rest for the first two years of a child's life, (2) allow the adult caregiver to be confident in their choice of infant gear by communicating comfort, ergonomics, and safety through both function and appearance, (3) incite an emotional attachment between the product and child, establishing the desire for long term use and an intuitive understanding of "baby's first chair" as a place of contentment, and (4) meet all regulatory rules and guidelines to ensure optimal baseline safety.

The team intends to work closely with all stakeholders to achieve these goals. We will continue our needfinding research for the duration of the project, engaging the primary stakeholders of parents and infant, as these are the users being designed for. Kids II will be a constant point of contact and resource in supporting the design process for the duration of this project. The ultimate goal is for this rocker to be featured by the secondary stakeholders, retail stores like Target and Walmart. To be sold commercially, the product needs to be compliant with guidelines put in place by the tertiary stakeholders, the government Consumer Product and Safety Commission, ASTM International, and the American Academy of Pediatrics.

Following the divergent and convergent process of empathy, creativity, and execution, we will explore the concept thoroughly yet detail the final design extensively. We will begin with divergent discovery. We will acquire knowledge both analytically and empathetically. As we reach a solid foundation of understanding, we will convergently forge ahead with a design brief that will define the project objective and design opportunity. As we continue into the ideation phase, again, we will use both analytical and creative processes to explore the entirety of the product's personality. Finally, we will converge onto a single design and develop a final, functional prototype.

Introduction

In the modern day state of hyperconnectivity, parents are researching every choice they make. Blogs, social media, store ratings, and an overwhelming amount of information is accessible, which presents a unique challenge involving communication in the infant gear industry that Kids II has identified. As an infant to toddler product design company, Kids II has the goal of creating "holistic solutions for early stage parents that transcend borders, categories

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and aisles".

This project is being carried out in an environment in which two conditions have been identified, including the lack of infant gear that maintains ergonomic integrity through the transition of infant to toddler, and the glaring discrepancy between the existing ergonomics of infant gear and parents' perceptions of the comfort of said products. This inconsistency is a result of perception being based on experience, and the commonly held inaccurate beliefs about comfort are a result of previously generated cognitive biases. Although a child may appear to consume the space inside of an infant-to-toddler rocker differently as they grow, this does not inherently mean that their sense of comfort changes. Because we can not eliminate all cognitive biases, our team must design an item of infant gear that adapts to the growth of a child doubling in weight both ergonomically and visually.

While the primary function of this rocker is to provide a place of safety, respite, and entertainment for infants and toddlers, the adult caregiver is also an essential primary stakeholder to design for. The adult user is ultimately the catalyst for all use of any infant gear. They are responsible for the cognitive processes that lead to the ownership and use of the rocker, as well as proper usage thus safety. Kids II is also an important primary stakeholder with high influence over the design of the product. While they have less influence, retailers of infant products are a secondary stakeholder that are vital to the market success of the product. Government and regulatory organizations have the least influence over the design of this rocker as tertiary stakeholders.

Project Objectives

The ultimate objective of this project is to develop an innovative and ergonomic baby rocker that adapts to the rapid growth of the infant user, optimizes interactions between the adult caregiver, the product, and the child, and both communicates and delivers comfort at all stages of child growth between four months and two years. In doing so, the product will allow parents to buy fewer

items of infant gear. This will in turn combat redundancy, reduce waste, save money, and focus safety, developmental growth, and emotional investment, and thus importance into one product, allowing it to be the ultimate piece of child gear.

Background and Research Summary

Comfort is subjective and poorly defined. In the early 20th century, comfort was considered to be a state of mind. This morphed into views held today, where comfort is considered to be a physical commodity like comfort food or comfortable furniture (Saeema, Stavros). When referencing the comfort needed by an item of infant gear, both emotional and physical aspects must be considered as rockers are frequently used to calm children down. It is difficult to determine what a comfortable rocker is for an infant because it can only be judged, not felt by the adult user or actively communicated by the child. Conversely, a toddler with free will can communicate comfort or discomfort both verbally and through their willingness to use the seat. A comfortable toddler seat is a product that the child enjoys using, creates a sense of relaxation, and ultimately becomes a chair that the child does not want to part with. A comfortable infant rocker is a product that cradles the child's body while not crowding it, and works to calm them down in moments of distress.

The infant gear industry includes companies that produce seats, rockers, bouncers, bassinets, and swings, but not all of the market's leading companies produce infant-to-toddler products. Competitors that do produce infant-to-toddler seating products include Fisher Price, an industry leader in infant products, Joie Baby, an e-commerce only retailer, Karmas, a brand sold at Walmart and Target, and Toyshine, a retailer found only on Amazon. Kids II holds the most diverse portfolio of infant-to-toddler rockers, with lines under the licensed Disney, Bright Starts, and Baby Einstein.

In a report titled "Global Infant Electric Rocker and Swing



Market 2018-2022", it was found that the market is expected to have a CAGR of 5%. The key factors driving growth have been identified as innovation and portfolio diversification. Parents want to see new and better options in an industry that has existed and remained relatively stagnant for decades. In light of the increase in working women in emerging markets, there is high need for infant gear and potential for market growth in developing economies. This is particularly notable in the consideration of an infant-to-toddler rocker because parents in developing areas generally need cheaper products that they can use for longer periods of time, presenting the perfect market gap ("Global Infant").

In determining needs of stakeholders, the team conducted surveys, interviews, and web based research. The team discussed goals, past research, and legal criteria with various stakeholders from Kids II. The primary finding in these meetings was the fundamental difference between true ergonomics and parents' perceptions of ergonomics when purchasing infant gear, which is the foundation for this project. Mitch Rolnick, the Kids II advisor for this project, illustrated key findings in the change in perception between generations of rockers on the same line, namely components that were more successful. It was found that there is a delicate balance between the bulk or size appearance of a product and whether parents will perceive it to be flimsy or unsafe. This becomes more difficult when you tie in perceptions of material strength based purely on appearance, and consider the desired weight for a product to be labeled portable.

The importance of marketing and emotional appeal was also brought to light during discussions with Kids II. Their research suggests that the value proposition of having gear that "grows with baby" is important in inciting parents' need for the product. It is not just an object that will safely hold your child for two years, but rather an emotional attachment that will comfort the child and ultimately become "baby's first chair". It is incredibly important to consider that regardless of how well a product ergonomically fits an infant, whether or not the child will use the product comes down to whether or not they want to use it. The infant-to-toddler rocker needs to be something

that a child will not get bored of the second they learn how to walk.

While the ethos of the product and the company mission should influence parents to purchase it, the design of the product should encourage infants to form an emotional attachment. This sentiment is echoed in a study done on the ergonomics of children's furniture that examines factors contributing to the long term use of traditionally very temporary products. It was found that designing a product with an extended life cycle is not just about durability and ergonomics, but also about the ability for the child to bond to the object. Thus, it is important to study cognitive growth alongside physical growth (Salvadore).

In order to examine how a parent and child use a rocker in their natural environment, the team conducted inperson interviews. It was found that parents move infant gear around with them, as the primary reason for use is to keep the child occupied but within viewing distance while the parent is busy. Surprisingly, a number of parents use infant rockers on elevated surfaces while cooking or doing counter-top work in an effort to have a better view of the child. This is ill advised and according to Archived Annual National Electronic Injury Surveillance System (NEISS) Data that records incidents relating to consumer products, is the leading cause of injury involving infant rocker use ("CPS").

The survey consisted of questions targeted at parents that both own and do not own rockers, with the purpose of understanding user buying decisions, understanding the different ways parents use rockers, and examining pain points in rockers. Key findings from the survey portion of our research referenced throughout this paper.

Previously mentioned infant-to-toddler products have fallen short in that they do not fit the ergonomic needs of the child during all stages of growth during the intended period of use. While the Fisher Price Infant-to-Toddler Rocker is the best selling, its design does not communicate the proper support of a small infant. Furthermore, it does not properly support small infants. There is a striking need for an innovative piece of baby gear that can be used and enjoyed for a longer period of the child's life.



Sustainability Criteria

As previously mentioned, modern parenting follows general societal trends now more than ever due to the rise in connectivity. Societal pressure is placed on parents to be "eco-friendly" and "socially-conscious", and some parents are using social media to capitalize on this trend. Whether because of judgement from the peanut gallery, because of a genuine desire to minimize environmental impact, or because of a susceptibility to the greenwashing of the modern consumer sales industry, it is clear that parents are influenced by the perceived sustainability of infant products.

By nature of being an infant to toddler rocker, this product has an inherently longer lifespan than most other conventional infant gear designed for a small period of child development. A core tenant of the design of this gear is to allow parents to purchase fewer products, limiting waste. This parallels the wants of parents, as seen in figure I, as 68% of parents surveyed said that they avoided purchasing additional baby gear because it was too similar to what they already owned. As seen in figure II, It was also found that over a third of parents surveyed obtained a majority of their baby gear through hand-me-downs. Because of this, it is essential that the rocker maintains a long life cycle beyond the initial two year use. We want to encourage reuse by communicating the stability, safety, integrity of the product.

To cause the least impactful harm on the environment, organic fabrics such as 100% organic cotton will be considered as a primary fabric material. This is an overall responsible option as organic materials are grown without the use of pesticides and other chemical fertilizers, and are ultimately better for the environment and the health of the consumer. According to the Global Organic Textile Standard, to be labeled organic there is social criteria that is met such as: employment is freely chosen, working conditions are safe and hygienic, child labor is not used, and working hours are not excessive (Bhajekar). Energy consumption is another aspect that will also be considered to make the product more sustainable. Eliminating the need for batteries and electricity to use the product

will allow for a purely mechanical device that promotes sustainability efforts.

User Criteria

Based on initial research, online forums, and personal interviews, we were able to unmask meaningful insights that assisted in the creation of our six user personas. The first, most obvious and most important persona category is the baby using the rocker. The next personas are the parents that are either classified as experienced and calm or first-time and nervous. 'Consumer-only' personas include the relative of the parent and the friend of the parent. By creating these personas, we hoped to design a product that covers all bases from form to function.

TIny Tiara is a 4-month-old infant who just started being placed in a baby rocker. She is a peculiar infant who needs to be physically placed in close proximity to her parental figure for comfort and safety. She also enjoys and needs a variety of soothing motions in order to calmly fall asleep. As all other infants, Baby Tiara physically and mentally grows at a fast pace and needs a variety of options in size and rocker attachments.

Little Lincoln is a 2-year-old toddler who has used a baby rocker since he was an infant. Lincoln is at the age where he loves exploring his independence and ability to walk around. Because of this, he is the one who decides to sit in his seat and when. He can be characterized as being restless because of his inability to sit still for long periods of time.

Lori Fields is a 34-year-old mother of three children that are 4-years-old, 2-years-old, and 8-months-old. Lori represents the first category of experienced, calm parents. Lori has had enough experience with children to know what products to buy and what to look for in new products. Price is her number one value in looking at baby gear - she wants to minimize costs as much as possible without sacrificing the safety of her child. She now usually gravitates towards buying and receiving second-hand gear for her youngest child. In terms of aesthetics, Lori has no concern with what a baby product looks like, as long as it



satisfies her functional need.

The third persona is Hannah Owen, a 25-year-old first-time mother to a 3-month-old daughter. Hannah represents the second category of parents which is the first-time, nervous and anxious parents. Hannah wants to do everything right, so she does extensive research online and asks those around her for advice. Because she leans more towards the modern, younger mom, she follows recommendations from lifestyle influencers on blogs and social media. After the safety and comfort of her child, she values how the aesthetics of the product fit into her minimalistic home. She is willing to spend money for functionality and appearance.

The fourth persona was Grandpa Fred Smyth, a 75-yearold male and grandfather to two young children. Grandpa Fred is the first of two personas in the 'consumer-only' personas who are important because they make up a large group that actually purchases baby gear. Their immediate opinions and purchase decisions matter in understanding what makes infant gear attractive to the buyer. Grandpa Fred loves his grandchildren but lives far away from them. Despite his distance and lack of knowledge on what his grandchildren actually need, he's looking to buy the surprise gift of a baby rocker for his youngest grandchild. He's a traditional man who isn't too savvy with new and overly-tech products so he gravitates towards traditional looking childrens' products. He values safety and function, however simple, as money is no object when buying a product for his grandchild.

Cindy Moore, a 28-year-old female, is a close friend to a recent first-time mother. Although she occasionally takes care of her friend's baby, she doesn't spend enough time with the baby to be an expert on what is liked and needed. While shopping for a baby rocker for her friend, she looks at the appearance before looking at the functions of it. She is open and eager to the idea of cool gadgets and tech integrated into the rocker, but she is also looking for reasonably-pricing.

The demographics of baby rocker consumers and users are typically middle-class females in their twenties to thirties.

With this said, baby rocker consumer demographics can range quite a bit because of the various purposes (e.g., for one's grandchild, as a baby shower gift, etc.) of purchasing one

Market Criteria

The infant gear market is filled with numerous and repetitive devices made from a number of companies, but not all infant gear companies produce infant-to-toddler products. Fisher Price is a US based toy company that sells the most popular infant-to-toddler rockers. The Fisher Price Infant-to-Toddler rocker is advertised for infants aged 0-3 years. These rockers offer an extended period of use by allowing the rocker to easily convert into a stationary chair through use of an extendable kickstand. The team was able to test this product with children on both ends of the age group, six months and two years old. As seen in figure III, the Fisher Price product does not properly support the infant as she is slumping over to the side. The parents being observed were dissatisfied with the need to remove the toy bar while strapping the infant in, and were concerned about the toys hitting the child's head while rocking. On the other hand, the rocker fits the toddler very well and can be positioned as "baby's first chair" as intended.

The Disney Baby Infant to Toddler Rocker that functions under similar mechanisms to the Fisher Price product was also tested. It provided a better fit for the infant but a poorer fit for the toddler, as seen in figure IV. While neither fit is poor enough to be considered unsafe, the product can not be considered to be ergonomic for either child. This rocker also had the same issue of the toy bar being obstructive when securing the infant.

The Toyshine Newborn to Toddler Rocker has an extendable support on each of the four ends of the frame that allow it to become stationary at will, serving the same purpose as the Fisher Price kickstand. This rocker also offers an adjustable recline to position the seat into a sleeper or a stationary chair. Both of these solutions are simple and uncreative.



Despite there being few products geared towards extended period of use, there are still many indirect competitors to be considered. This is because of the large similarities between rockers and bouncers and the abundance of very popular shorter life rockers/bouncers. As previously stated, the primary reason parents do not buy a rocker is because they feel is it too redundant to the bouncers that they already own. They ultimately felt that the baby rocker did not offer enough additional value to justify buying a separate product.

There are two popular baby bouncers will long advertised lives that will be competition with our product. The first is the Babybjorn Baby Bouncer, which features a reversible seat cover that has an infant saddle on one side and a blank reverse side. This paired with an extendable kickstand allows the bouncer to be converted into a chair at will. Perhaps the most unique of the long life products is the Stokke Steps by the Permafrost Design Studio. This modular baby bouncer comes with several supports that can added or removed to turn it into a highchair, stepping stool, and even a raised recliner. This solution presents unique problems including the need for constant storage of multiple parts that are not in use and the possibility of losing said parts, rendering the set useless. Another competitor will be the Fiddle Diddle Play n Rock Sleeper/ Bouncer/Rocker by The Flyers Bay. This 3 in 1 device can easily be used as any of the three devices and offers flexibility that many other products cannot match. While it does not offer as long a period of use as the other competitors, the ability to do all three things makes it a popular item for many parents only wishing to purchase one product.

Kids II maintains a unique market position in that they believe in introducing high-tech features only when they add functionality. The company boasts offering the same features as competing products at a lower price. They aim to go from a "fast follower" model to being a "pace setter" in the industry through logical innovation and intentional design.

Ergonomic Criteria

The ergonomic criteria that needs to be considered in designing infant gear pertains to both the adult caregiver and the infant. This criteria is established with the goal of maximizing usability while minimizing risk. To do so, the following areas must be considered:

- 1) Guidance
 - a) Inform the adult user of proper usage
 - i) Prevention of risky behavior through physical feedback
 - ii)Prevention of risky behavior through education
- 2) Workload
 - b) Physical
 - i) Assembling, disassembling, and reconfiguring the product
 - ii) Creating motion
 - iii) Moving the product
 - c) Cognitive
- 3) Usability
 - a) Grouping
 - b) Comfort
- 4) Safety
 - a) Regulatory compliance

5.4.1 Guidance

The role of guidance is to advise and inform the adult caregiver in proper product usage, ultimately preventing risky behavior. This will include comprehensive safety labeling and user manuals as defined by ASTM standards, and may potentially include physical feedback that prohibits dangerous behavior or makes the adult user aware of their dangerous actions. Examples include a toy bar that detaches easily upon pulling as to not allow the user to lift the rocker with the toy bar, mechanisms that do not allow rocking unless the safety straps are engaged, or auditory and haptic feedback indicating misuse.

5.4.2. Workload

Ergonomic criteria regarding workload involves both users of the product, the infant and the caregiver. The amount and type of effort involved in assembling, disassembling,



and reconfiguring the product should minimize strain on the adult caregiver while still ensuring that the product requires effort that is intentional and great enough in extent to where said effort would not be expended while in use by the infant. The workload in creating motion may be as minimal as pushing a button to incite battery-powered movement, but may also require body movement by the infant or action by the caregiver. The product should be light enough to minimize workload during moving but heavy enough to ensure structural integrity and stability.

5.4.3. Usability

Ergonomic criteria for interface usability primarily concern the adult operator, or caregiver. Considerations include the location and arrangement of touchpoints that control rocker settings and safety components while in use by the infant, and features that assist in assembly, disassembly, or reconfiguring, while not in use by the infant. There must be clear visual distinction between functions of any interface features.

The rocker must ergonomically fit an infant that more than doubles in weight, as seen in figure V, for the intended duration of use. It is important to note that during the first two years of life, children gain weight at a faster rate than they gain height and limb length. A 5th percentile three month old infant weighs 4.9 kg and has a height of 54.1cm, while a 5th percentile two year old toddler weighs 7.8 kg and is 74.4cm tall ("Anthropometry of Infants"). A critical point in child development occurs when they learn to walk at anywhere from nine to 15 months old. This is important in the design of this infant to toddler product because children gain autonomy at this point, and may begin to use the product independently, as a toddler seat rather than an infant rocker.

5.4.4. Safety

Ergonomic criteria regarding safety will be led by regulatory guidelines regarding consumer goods. Perhaps the most significant change in ergonomic needs of an infant occurs between four and 6 months when a child develops the ability to hold their head up. This development is fundamental in in allowing the development of all other movements like rolling over, sitting up, crawling, and walking. It is

recommended to begin propping infants up into seating positions at the three month mark as a means to incite curiosity in their surroundings and encourage postural development (BabyCentre Medical Advisory Board). However, a child that can not hold their head upright independently for an extended period of time should not be placed in gear that has them in a seated position as this can lead to airway constriction and asphyxia. A seat must be reclined between 0 and 45 degrees to ensure that the airways stay open in an infant that does not yet have head control (Hubbs-Tait, Laura, Peek). This poses an ergonomic problem in designing a product that can be used both during the phase of necessary recline and during the time where sitting upright is not only healthy, but also critical to development.

Correct support and positioning is also imperative for prevention of Sudden Infant Death Syndrome (SIDS), which remains the leading cause of infant mortality. This is particularly pertinent to the design of baby rockers because it has been found that trending products being advertised to parents frequently pose risks. When studying magazine advertisements of infant products, it was found that 35% of images show sleep environments nonadherent with the American Academy of Pediatrics (AAP) guidelines for safe sleep (Kreth, M, et al). While infant rockers are not approved for sleeping, advertising does depict that behavior.

In a study examining cases of infant mortality while using sitting, laying, and carrying devices, 46 of the 47 cases studied were a result of asphyxiation. The average amount of time elapsed between when a child was last seen in the gear and when the child was found dead in the gear was greatest for infants that died in swings/bouncers at 225 minutes, as compared to 26 minutes in slings, 32 minutes in strollers, and 140 minutes in car seats (Batra, E K, et al). In conducting preliminary user research, we found that nearly a 50% of parents use rockers for sleeping. As a soft, non-flat surface, the standard rocker does not follow the AAP guidelines for safe sleep. This reveals multiple possible implications in the use of stimulatory child gear like swings, rockers, and bouncers:



- There is an inequality between caregivers' expectations of safety and true safety
- 2. Caregivers are not using infant gear properly
- 3. Caregivers are not adequately monitoring the use such infant gear
- 4. Infant gear is unsafe because of poor ergonomics that lead to asphyxia

Each of these potential issues can be addressed through proper design following the previously referenced ergonomic criteria of guidance and safety.

Functional Criteria

Parents use baby rockers for a variety of reasons. As discovered through surveying parents, common reasons they use rockers include to allow the infant to nap, to safely set the infant down when busy (e.g., taking a shower, cooking, folding laundry), to soothe or calm an anxious infant, or to occupy and entertain the infant and/or toddler. These use cases inform the following parameters that guide in the design of a product that appeals to both parents and infants:

- The rocker must properly fit and ergonomically hold an infant as young as 4 months old and as old as 24 months.
- The rocker should essentially 'grow' with the child as they physically and cognitively develop.
- The rocker should be appealing to the infant in that it makes them feel both comfortable and comforted.
- The rocker should be appealing to the toddler in that it
 provides a place of rest and encourage the first aspects
 of childhood independence and bodily autonomy.

Based on survey results, insights from Kids II, and interview findings, it can be concluded that while toddlers using an infant-to-toddler rocker can use the rocking functionality, they prefer to use said product in the stationary mode. The rocker essentially becomes a chair for the child in which they can independently sit down and get up without utilizing the restraint system. Every parent surveyed that indicated their child aged 18 months and up uses an

infant-to-toddler rocker said that the primary function is to keep the child occupied. This contrasts with parents of younger infants, who primarily said that the purpose of a rocker is to provide a safe space to put the child down while they have their hands busy. This illustrates the significant differences in product configuration and reason for use among the two age groups in question.

In terms of performance, the infant-to-toddler rocker must be able to provide a motion that will soothe the infant and possibly encourage a napping environment. This motion should be adaptable to different children in age and to [the child's] preference. It must also have a stationary configuration available to cater to the older toddler user, positioning itself as "baby's first chair". As shown by figure VI, nearly half of parents that own rockers bring them on trips. Because of this, the rocker must also be able to perform in the same manner in various environments and should be easily collapsible and/or portable in order to smooth the process of storage and travel.

Material and Physical Criteria

Aspects that drive physical dimensions of this design include the ability to comfortably fit a 4 month old growing to two years old, the daily interaction between the parent and the rocker, the size when stored in a warehouse or store, as well as the size when not in use in the home. As shown in figure VII, a number of parents store rockers when not in use. Based on current products on the market that have been designed for growing with baby, the dimensions of the product should be approximately 25 (height) x 16 (width) x 22 (length) +/- 10 inches for each measurement. To be considered portable, the weight of the rocker should be less than 10 pounds and collapse to half of the original size in at least one dimension. The rocker will be used in indoor settings and transported, so it must withstand a range of low and high temperatures without material degradation. Figure VIII displays possible material choices for fabrics that can be used as well as pros and cons of each.



Because of how important comfort is, it is necessary to evaluate the properties of fabric that make it considered to be comfortable. The first important property is the how well the fabric absorbs moisture. When skin is pressed against a surface, sweat will begin to accumulate regardless of the ambient temperature. If the fabric easily absorbs liquids, the sweat will not build up on the skin, which is important to comfort. The softness of the surface of the fabric is a massive factor in perceived comfort and relies upon the flexibility of the fibers. Surface haptics, how warm or cool a fabric feels, also needs to be considered because people often correlate warmth to softness when feeling a surface. Therefore, the thermal effusivity of a material is an important parameter.

Elasticity of the fabric is very important for comfort in terms of an infant rocker. Since the infant will be placing their entire weight on the seat, the fabric needs to be elastic enough to contorts to the shape of the body while under stress. If an inelastic fabric is chosen, the rigidity will not make for a comfortable fit. If a thicker seat is decided upon, foam is commonly used as a filler. Foam has a very low density and high elasticity which results in the "sinking into the cushion" feeling that so many people attribute to comfort. While high elasticity might be desired for comfort, too much elasticity can cause issues with the posture of the resting child. The same can be said about foam. In order maintain proper ergonomics and be "comfortable" for an infant or toddler, a balance needs to be struck when deciding on material choice.

Manufacturing/Production Criteria

The relationship between production quantity and cost will differ depending on the manufacturing method used for each part and the type of assembly required for the finished product. The majority of baby gear comes in a box that needs to partially assembled by the owner. The base frame of the baby rocker is seperated in the box and can be assembled easily, typically by snap fitted pieces. The seat should easily slide onto the frame for optimized

shipping or transportation.

For large scale production, the frame components will be mass produced using plastic injection molding, and the seat cover will be mass produced using an advanced sewing operation. This is only an appropriate method if rockers are produced in large amounts, where the cheaper unit cost outweighs the larger machining costs. The frame units could alternatively be 3D printed or hand machined, and the seat could be sewn. This would result in a higher unit cost but it would still be cheaper overall when considering machining costs of a more large scale manufacturing production.

The seat cover can either be a sturdy, thicker cushion or a simple mesh lining. If a thick cushion is decided upon, the base will consist of foam covered with polyester batting and topped with a seat cover. There are a plethora of possible materials that can be used for this cover, each with its own merit. The material needs to be resistant to high heats so it can be washed, stain resistant, and most importantly, soft and comfortable. These covers would be made by sewing the fabric over a mold, and elastic will likely be used to maintain the position of the cover on the seat.

Aesthetic/Emotive Criteria

Emotion is an essential influencer to the purchase of baby gear by parents, and Kids II excels at marketing emotional appeals to parents in the form of empathy and understanding. Their brand ethos revolves around making parenting easier by accumulating "tiny-wins", which must be made clear through the design of this infant-to-toddler rocker. The personality of the product is defined by the aesthetics, associations, and perceptions that surround it.

Jurisdictional Criteria

While there are a large number of standards concerning consumer products for infant use, they do not strongly affect project goals. Ergonomic infant gear that adapts to infant growth must be compliant with the following



specifications, as referenced by the Consumer Product and Safety Commission:

- ASTM F3084—18 Standard Consumer Safety Specification for Infant and Infant/Toddler Rockers
- ASTM F2613—17a Standard Consumer Safety Specification for Children's Chairs and Stools
- 16 CFR Part 1501 Method for identifying toys and other articles intended for use by children under 3 years of age which present choking, aspiration, or ingestion hazards because of small parts
- While not required by law, the team is choosing to follow guidelines put in place by the American Academy of Pediatrics regarding best safety practices.

Distribution/ Implementation Criteria

If Kids II wishes to continue development and fabrication of the team's design, the final infant-to-toddler rocker will become the property of Kids II and the team will be compensated for the conceptual development of the product. After final fabrication of the product, the infant-to-toddler rocker will be displayed and marketed on the Kids II online platforms (i.e., their website). The product will also be distributed to Kids II's business partners and any other retail stores associated with Kids II.

In an ideal situation, the final product will be displayed in multiple baby retail stores, including superstores (e.g., Target), where consumers can physically interact with the product. It will also be available online on these retailer's websites as well as Amazon, where photos and videos will be included to digitally depict the functionality of the product.

Cost Criteria

As previously mentioned, the Global Electric Rocker and Swing Market 2018-2022 report cites growing demand for infant gear in low to middle income communities. The Ingenuity line of products is considered to be mid level,

with similar non-electric rockers costing around \$60. As determined by needfinding research, price is a key factor for parents. The Kids II manufacturing and distribution model typically results in products being sold for 5-6x the cost of production. Because of the team's resources, prior knowledge, and research insights, the rocker being designed should be in a similar price range to current products.

Contacts and Resources

Mitch Rolnick, Principal of innovation at Kids II, is the primary contact for the team. He has put us into contact with the company's legal support team in regards to regulatory compliance and has supplied resources, both intellectual and physical, to support this project.



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Figure I

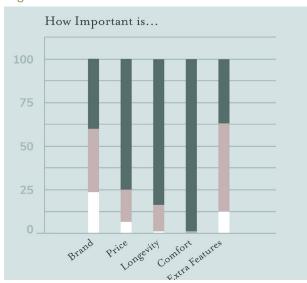


Figure 2

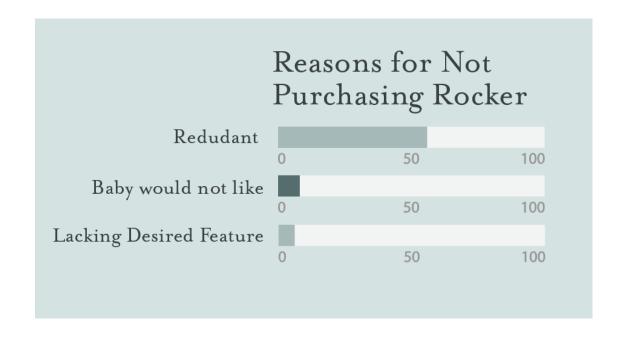










Figure V

Age (months)	Percentile	Weight (kg)	A. Height (cm)	B. Crown- Rump Length	C. Shoulder Breadth	D. Upper Arm Length	E. Forearm Length	F. Waist Breadth	G. Hip Breadth	H. Leg Length	I. Thigh Length	J. Knee-Sole Length	K. Foot Length
3-5	5	4.9	54.1	37.5	16.5	10.7	14.1	10.6	11.5	23.4	12.7	14.6	8.2
	95	8.2	68.2	45.8	20.4	13.8	18.5	14.7	16.7	30.3	18.5	18.2	10.2
6-8	5	6.4	64.2	42.3	18	10.8	15.7	11.8	14	25.7	14.3	16.5	8.9
	95	9.4	72.2	50	22	14.7	19.5	15.2	17.5	33.5	19.5	19.3	11
9-11	5	7	66.2	43.3	19.3	12.3	16.8	11.7	13.5	27.6	15.8	17.4	9.7
	95	10.9	77.4	50.7	23.1	15.6	21.6	15.6	18.4	39.7	21	21.8	12.1
12-15	5	8.4	69.8	44.6	19	12.9	18.4	12.8	15.3	32.3	16.8	19.4	10.2
	95	12.6	80.7	51.8	23.3	16.2	21.3	15.3	18.4	39.5	22.6	22.6	13.1
16-19	5	8.3	72.6	46.6	19.2	13.8	18.5	13.1	14.1	31.5	18.3	19	9.8
	95	13.5	84.6	53.5	23.6	16.6	23.1	16.3	19.3	41.5	24	23.3	13.3
20-24	5	7.8	74.4	46.9	20.3	14.2	19.5	13.2	15	35.1	18.7	19.8	10.5
	95	13.2	88.3	54.9	23.9	17.4	23.3	16	19.1	45.5	26.5	25.3	14

Figure A

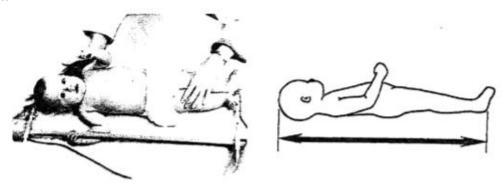


Figure B

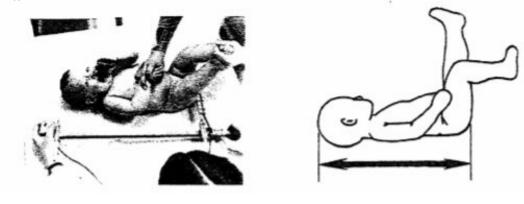




Figure C



Figure D

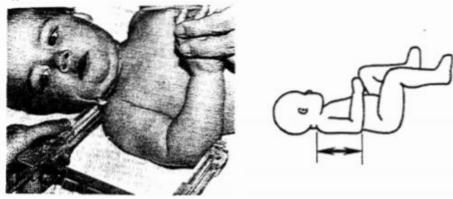


Figure E



Figure F

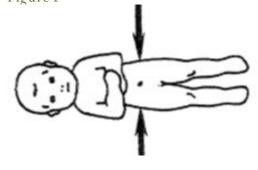




Figure G

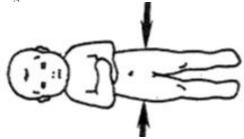


Figure H

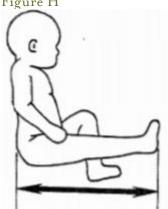


Figure I



Figure J

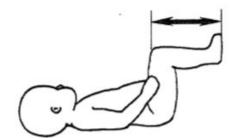




Figure K

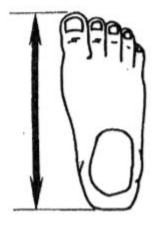


Figure VI



Figure VII



Figure VIII

