An Approach to Create a Commercially Successful Portable Electronic Audio Device Through Design and Marketing.

by

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Abstract

Ever changing technologies and market conditions feed the need to continually research and update product design. Specifically, within the music technology sector, electronic audio devices (EAD) are advancing every year. Throughout the various consumer audiences, electronic audio devices have a lasting and memorable impact on the user. There needs to be an approach for designing and marketing EADs that is better able to produce a commercially successful product. Combining marketing and design creates an ideal user experience for the consumer. In this study, there will be interviews from successful companies and descriptions of how their product lines are developed through the combination of their design and marketing teams.

Design and marketing strategies will be collected, analyzed, and discussed. Properly combining design and marketing aspects are key to creating a commercially successful EAD and obtaining positive returns on investments. Additionally, well-defined approach for the design team that is in line with the marketing teams' strategies ultimately leads to a more commercially successful and innovative EAD.

Acknowledgments

I would like to thank my committee, Rusty Lay, Rich Britnell, and Chris Arnold. They assisted me throughout my writing, answered my endless questions, and gave me great advice and support. Thank you to Beth Topping for reviewing and editing my writing.

Special thanks to Rusty, he gave me more of his time than I deserved and regularly met with me over two years. I am especially thankful to him for helping me tackle any type of question I had, big or small. He even listened to my problems I was having in my day to day life. Thank you.

As the writing was coming to a close, my father possibly proofread my thesis nearly as many times as I did. Even when I became discouraged in my own work my parents were there with their constant support and encouragement. I am forever grateful to them.

Software Used

Style manual or journal used:	APA Style, Sixth Edition
Computer software used:	Fusion 360
	Adobe Illustrator
	Adobe InDesign
	Microsoft Office
	Microsoft Excel

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Chapter One

Introduction

1.1. Problem Statement

The EAD industry serves a broad range of consumers focused on audio and music. There are various design factors, such as aesthetics, semantics, and functionality, that when combined thoughtfully can create an exceptionally designed product. There is not a single or explicit approach for creating a well-designed EAD. Well-known brands like Apple Inc., Sony, and Bose each have different design and marketing philosophies, but all have brand loyalty and consumers who believe and trust in their products. This loyalty and trust derive from overlapping successful design and marketing strategies. There is not a dogmatic way to create a product, but some key principles that lead a designer and the marketing team to commercial success with a product. As technology and consumer expectations change and evolve, there needs to be an approach for design and marketing teams that enable them to incorporate rapidly changing technology and fluctuating consumer desires. Many of the current products and marketing strategies can influence consumers to buy lower quality products and unknowingly dismiss innovative products that are not marketing themselves well.

Another issue in EAD design is product waste. Poorly designed EAD's often use lower grade materials that require more of it to construct or aren't durable. In Chapter Two of this study, a case study of the SanDisk Clip Jam MP3 player, a mediocrely designed but well-advertised EAD, is reviewed. The product has simple mechanics and function in comparison to other EADs. Consumers celebrate the inexpensive plastic product and do not feel emotionally burdened or attached to it. In contrast, Apple and Microsoft MP3 players are celebrated decades

after production, in part due to the durable aluminum body and internal technology components which enables them to still function today (Devine, 2017).

This study will describe ways to improve a product's quality, user experience, and marketability through a better design and marketing process that results in more durable and longer lasting products. Poor quality products have shorter lifespans due to lower quality materials and substituting low end alternatives for various components. The consumer often treats these low-cost devices as disposable and inconsequential products. This mindset actually wastes the consumer's time and money, and contributes to degrading the environment. As Dieter Rams explains in the book *Rams* by Gary Hustwit, (2018) "The time of thoughtless design for thoughtless consumption is over" (p.29). This approach proposes design and marketing guidelines that will assist in developing high quality EADs that will improve the user's experience, the company's return on investment, and the environment by reducing toxic electronic waste in landfills.

1.2. Need for Study

1.2.1. Market Demand

The EAD industry is a vast, growing market. According to Statista.com, in 2017 sales of home audio equipment was a $3 billion-dollar market in the United States with compact audio systems reaching 90 million consumers (Statista Research Department, 2018). The electronic audio market has consistently been in high demand in the United States and new technology continues to create new products to maintain the EAD industry's rapid growth. A figure from Global Market Insights predicts that United States home audio equipment will almost triple by 2024.

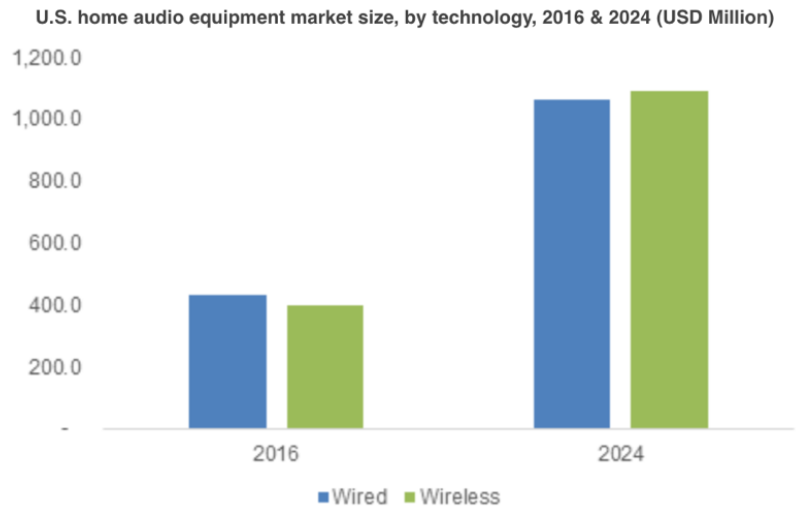


Figure 1. Industry Trends (gminsights.com, 2016)

Recent technology development and changes can be observed through smart phones, smart home devices, and multi-function smart watches. According to Statista.com, the global market for smart homes is 2 billion and is predicted to reach almost 54 billion worldwide by 2022 (Liu, 2019).

Innovative technologies create new markets and design opportunities in the EAD field such as enhanced portability, streaming, touch screen, customization, material use, and overall user experience. The growing EAD market is cluttered with tired design and requires more thoughtful compositions and marketing approaches to improve the product, the user experience, and the company's return on investment. The EAD needs to remove itself from the "red ocean" market space and aim for an EAD that makes the competition irrelevant and captures a new demand.

Simply, if quality products are in the consumer's day-to-day social and/or consumer environment, they are likely to purchase them. It is a normal, sensible thought process to prefer good experiences over bad experiences. If a product does not achieve the needs of the user, it will be abandoned by the consumer and market. Henry Van de Velde states how to know if a

product is valued by society, "… namely that a man's worth can be measured by the number of people who have derived use and benefit from his life's work" (Gorman, 2003, p.48). Velde measured the worth of his honest and rational products by the number of people his products touched. If the consumer has the ability and opportunity to choose a higher quality product or service, they will instinctively pick it. This principle is demonstrated in the EAD industry where consumers are aware of the "superior" products in the market. It is seen time and time again with the product ecosystem Apple has developed. Consumers crave the high quality that Apple advertises and delivers through both their products and the interconnected services, not the least of which are their EAD offerings. Overall there has been a general growth of Apple products and their services as shown in this Statista chart illustrating product sales from 2013 to 2019. Apple has a range of products and services that have created an ecosystem within the technology services. The products work together, improving Apple's chances to assimilate their products for an enhanced user experience.

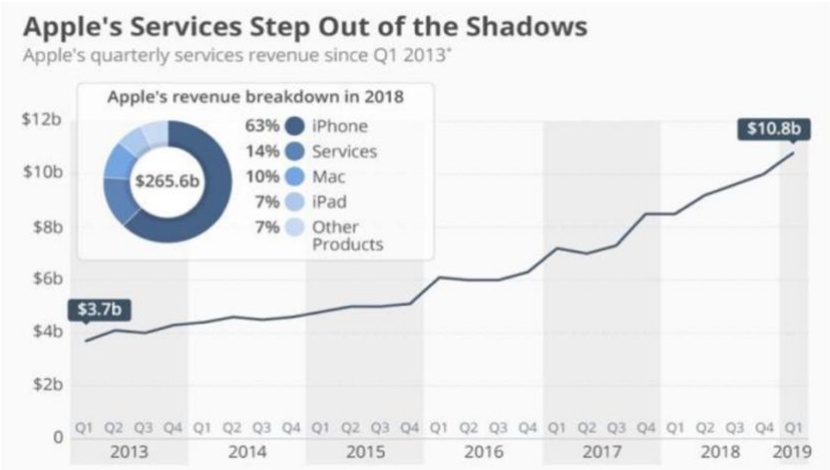


Figure 2. Apple's Services Step Out of the Shadows (Statista.com, 2019)

Another chart from Business Insider shows that in 2015 Apple sales surpassed other companies. There are many factors that drive sales but to be superior above all the rest, consumers must believe they are purchasing the best product for themselves.

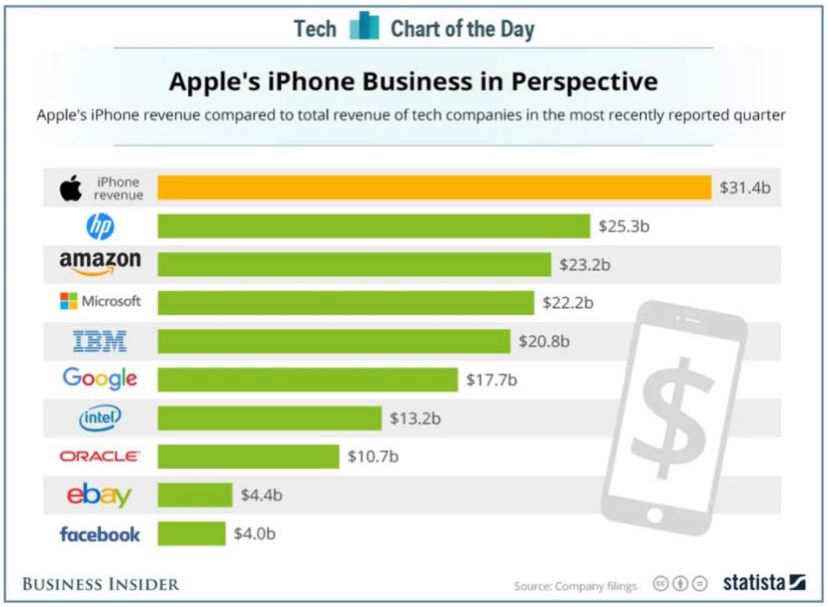


Figure 3. Apple's iPhone Business in Perspective (Businessinsider.com, 2015)

1.2.2. Environmental Concerns

A thoughtfully designed product is made with suitable, appropriate materials in order to create durable and long-lasting products. For example, a technology-based product must carefully consider the temperature, ventilation, and integrity of the product's parts for it to function, last, and be safe. Nintendo Products are known for their technology products durability. In 2017 a team, UnlockRiver, demonstrated this theory by dropping the Nintendo Switch from 1000ft in the air after which the product still functioned. This is an extreme instance, but it is still noteworthy. Long lasting products can create an emotional connection between the consumer due to their reliability and long-term day-to-day use. The longer a product can be used, the more likely it is to surpass the amount of energy it took to produce it (Thompson, 2013).

Whether the consumer is aware of it or not, purchasing a durable product is likely an environmentally friendly decision due to the long-lasting nature of a durable product. According to Worldcounts.com, there are 40 million tons of electronic waste created every year worldwide which comprises almost 70% of our total toxic waste (Theworldcounts.com, 2014). Electronic waste contains lead, palladium, mercury, lithium, and other harmful chemicals. Not only is this extremely damaging to the environment, but without safe recycling, these components turn into toxins and become a health hazard for society. In landfills toxins can leach into underground water sources and affect the population directly without them ever coming near the source of the toxin. According to GreenCitizen.com (n.d.) the toxins can cause severe damage to the central nervous system, kidneys, reproductive/birth defects, brain damage, and when burned they create cancer-producing dioxins. Creating longer lasting, environmentally friendly designed EADs will improve the health of the environment and society by lowering the amount of e-waste.

Toxic Materials	Birth Defects	Brain Damage	Heart, Liver, Lung & Spleen Damage	Kidney Damage	Nervous/ Reproductive System Damage	Skeletal System Damage
Barium		X	X			
Cadmium	X		X	X	X	X
Lead	X	X		X	X	
Lithium	X	X	X	X	X	
Mercury	X	X	X	X		
Nickel	X		X	X	X	
Palladium	X	X	X	X		
Rhodium			X			
Silver	X	X	X	X	X	

Table 1. E-Waste Toxic Components and their Damage to Human Health (GreenCitizen.com, 2018)

1.2.3. Environmental Design Decisions

If an EAD is designed with modularity in mind it can also reduce the environmental impact because the body and components can be easily assembled and disassembled. It will make it convenient for a company and/or the consumer to recycle, reuse, or responsibly dispose of the EAD parts. Within the book *Eco Design*, by Alastair Faud-Luke (2010), he explained using lithium rechargeable batteries in technology is vital. It reduces the resources used to create the batteries themselves. The designer should attempt to include a battery life of 15 hours or more (p.163). The reading explains that using lightweight materials, reducing overall material used, using renewable energy options, and incorporating shock resistant material can be beneficial and improve the sustainability of an EAD. Overall using less materials and energy produces less waste.

The book, *The Sustainable Manufacturing Guides: Sustainable Materials, Processes, and Production* listed multiple concepts to review when developing a product. The list below should be referenced during the design and production phase of the EAD to lessen the product's impact on the environment (Thompson, 2013).

1. Satisfy real needs rather than transient fashionable or market driven needs.
2. Minimize the ecological footprint of the product/material/service, reduce resource consumption including energy and water.
3. Harness renewable energy resource.
4. Minimize CO2, greenhouse gases, and waste in production.
5. Improve resource efficiency and reduce ecosystem damage.

6. Design to enable separation of components of the product to encourage recycling or reuse of product.

7. Attempt to limit or exclude the use of toxic substance.

8. Attempt to use local resources and material.

The manufacturing guide also suggests which type of materials should be used in electronic products and packaging such as cardboard pulp, paper, cardboard, aluminum alloy, glass, and basic plastics. These materials are relatively safe to access, recyclable, and can be reused. While some of these materials such as aluminum cannot decompose, it can be reused over again if properly handled. Even if some of these materials are placed in landfills and are biodegradable, they are unlikely to decompose due to the of the lack of oxygen exposure for decomposition. Decomposing materials can produce methane gas, which is also a greenhouse gas and contributes to global warming (Thompson, 2013).

Nike has developed a digital material library that can be accessed through the Apple Store for free called, Making. The focus of the information contained there is to environmentally rank a material and their effects on the environment. They also suggest alternative similar materials so the designer can choose a more environmentally friendly one. The library primarily reviews chemistry/chemical use, energy use, water use, and waste that is created from each material in developing its lists. The App also highlights the environmental attribute score which is defined by the use of Green Chemistry, Organic content, and Water Conversation for a specific material and supplier. It also notes the ranking of the typical suppliers for certain materials and how much water, energy, waster, and green chemistry they use to extract a material.

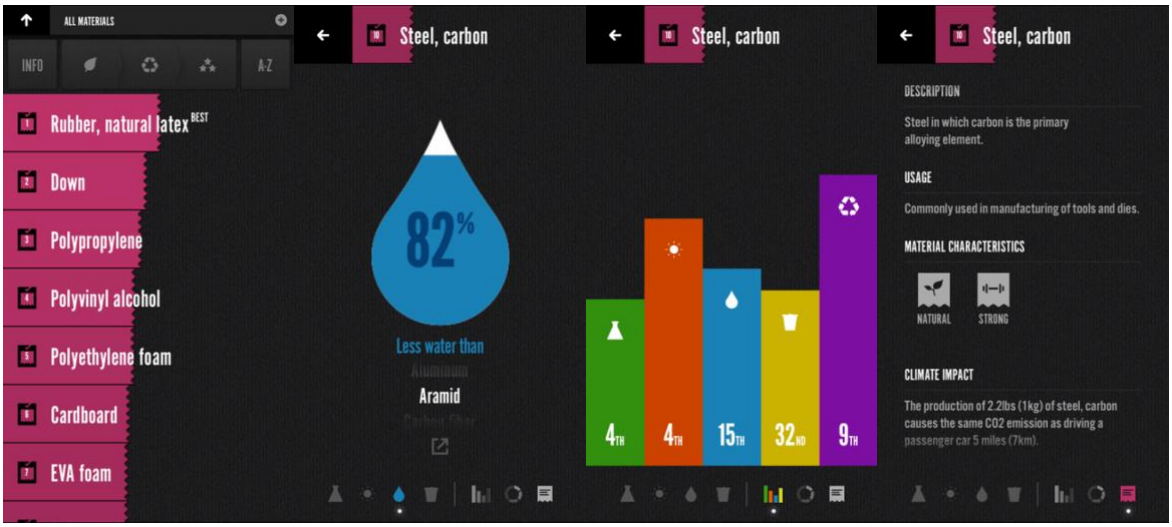


Figure 4. Left to Right – Making App in Use

As an example, the figure shows the different characteristics of steel and shows similar materials such as aluminum, carbon fiber, and others. It then shows how steel ranks in the different categories and the recourses used in the production of the material. Overall, it contains a description of the material, where it is used, its characteristics, the climate impacts, and where in the world it is typically sourced. A designer can easily reference this App to get a quick overview of a materials impact on the environment in order to make a more informed decision on their choice of material to use in a design. Other resources that can be used to assess the environmental impacts associated with a product are Gabi-software.com, ecoinvent.com, simapro.com, and by referencing Okala's life cycle assessment method. Numerous other references can be found in the book *Okala Learning Ecological Design*, Chapter 11. There is also a material and manufacturing process list that includes CO2 impact found within this book.

1.3. Objectives to Study

The overall objectives of this study are:

- To study techniques of effective marketing, including research about different types of advertising, strategies for product pricing, product placement, and trends.

- To investigate the user's needs and desires in a well-designed EAD. Understanding the functionality of an EAD as it relates to technology, quality, aesthetic design, and UX/UI design.
- To collect a comprehensive pool of information focused on EAD semantics in order to create a user-friendly and intuitive product. Specifically, focusing on the hierarchy of controls and buttons: menu, volume, skip, pause, and/or playlist controls.
- To recognize what aesthetics, materials, weight, color, and other visual/physical influences are attractive to consumers and convince them to purchase the product.
- To gain insight on developing brand loyalty.

1.4 . Definition of Terms

Aesthetics: Shape, form, color, texture, symmetry, and proportion that appeal to ones senses or style (Reward Learning, 2011).

Archetype: A typical example of a certain persona. Typically, the consumer/audience a brand is targeting or references in research and develop.

Brand Loyalty: The tendency of some consumers to continue buying the same brand of goods rather than competing brands (Muhammad, 2017).

Consumer Trends: Behaviors that are prevalent among consumers of a good or service. Consumers' trends track how much consumers spend and how they communicate with brands and social media (WebFinance, 2018).

Design: The arrangement of components, aesthetics, and function in a product or artifact.

Disruptive Product: Describes a process by which a new product enters the market and eventually displacing established competitors and replaces an array of products. The smart phone

is a clear example because it replaced other products such as calculators, paper maps, and landline phones (Clayonchristensen.com, 2012).

EAD: An abbreviation for electronic audio device.

Experience Design: Similar to UX, products or a service focused on the quality of the user experience.

Good Design: This study uses Dieter Rams' Ten Principles of Design as its foundation to define and explain what makes a product/serve exceptional.

High Fidelity: Also known as hi-fi, refers to high quality reproduction of sound and distinguishes it from lower quality produced sounds.

Iconography: The use of symbols and icons instead of words to communicate a word or meaning. Good iconography can communicate faster and be more effective than words and remove language barriers.

Industrial Design: Developing products that optimize the function, appearance, and fits well within a system and be efficiently produced by the manufacturer.

Marketing: Business of promoting and selling products. Includes market research and advertisements.

Marketing Ploy: A tactic used by marketers to push more sales of a product or service. "Ploy" suggests it tricks the consumer into purchasing the product whereas normally they would not. It can often lead consumers to feeling taken advantage of and distrust for the company (Newton, 2017).

Moore's Law: Implies that computing power becomes smaller, faster, and cheaper with time. Microchips double their capabilities every two years while the cost is halved. Computers and other technology devices speed up and costs lower (Tardi, 2020).

Product Semantics: The ways form, graphics, color, and other visible characteristics of a product could communicate additional meanings to the users (oxfordreference.com, 2019).

Planned Obsolescence: Producing consumer goods that are designed to become obsolete. The product can have frequent design changes, the company can end production of spare parts, or use nondurable materials (Dictionary.com, 2019).

Quality: In manufacturing, a measure of excellence and lack of defects. Additionally, the product/service achieves satisfaction for its purpose of use (businessdictionary.com, 2019).

Red Ocean: The known market space. An area where industry boundaries are defined and companies try to outperform their rivals to obtained more of the existing market (BlueOceanStrategy.com, n.d.).

Return on Investment (ROI): A way to measure and evaluate performance of an investment. To calculate ROI, the return of an investment is divided by the cost of the investment (Investopedia.com, 2019).

Semantics: The relation between signifiers, phrases, signs, and symbols, and what they stand for (Semantics.com, 2018).

UI: User Interface, refers to graphical user interfaces and occasionally includes physical, 3D graphics.

User Friendly: A product or service that is easy for the consumer to use and understand.

Visual Affordance: Visual clues to how an object should be used. It can be typically provided by the object itself or its context (Teamtreehouse.com, 2014).

Wireframe: Commonly used to lay out content and functionality on a page which takes into account user needs and user journey (Experienceus.co, 2019).

1.5 . Assumptions

Throughout this study, there are assumptions regarding consumers when they are researching and deciding to purchase an EAD. Human behaviors and consumer consumption habits cannot always be predicted precisely. There are instances in the study when the most feasible scenarios are identified.

One assumption is that a consumer, when given the opportunity and with no known major negative impacts on themselves or environment, will chose a high-quality product over a lower-quality product. For example, so long as the price of the product seems fair and reasonable the consumer will feel comfortable purchasing it over a lower quality product where initial cost is not a factor. Additionally, in this study there will be the assumption that the majority of consumers, consciously or sub-consciously, find themselves purchasing well-designed products. In contrast, there is an assumption that there is, and always will be, a smaller group of consumers that will buy the lowest quality product for various reasons. The product could have bad reviews, limited durability, publicized negative impacts on the environment, or be designed poorly, but this group of consumers will still knowingly purchase it due to their personal desires, philosophy, or limited resources.

Another assumption is that when a consumer is searching for a specific product, the expected lifespan of the product influences the purchase. The quality, material, and price give the consumer an impression of its lifespan. For a product they expect to use every day and depend on, consumers are willing to purchase a more expensive, durable products. For example, when a consumer knows they will use a smartphone every day it, influences them to purchase a higher priced device. On the other side of the spectrum, someone who knows they are only going to use

a device a few times a month is more likely to purchase a lower end, less expensive product which does not have the durability of a product used daily.

This study assumes the designer using this approach has been educated in general design fundamentals such as color theory, ergonomics, visual hierarchy, and topics of that field. Additionally, the study assumes the designer will design the EAD as universally as possible. That includes applying accessibility to the design and using standardized components, such as fasteners, within the EAD.

1.6. Scopes and Limits

Scopes

The thesis will be developed and conducted over an 18-month academic period, starting in August 2018 and ending in April 2020. The study will mainly involve information from literature, journals, lectures, videos, interviews, and online resources. During the study intensive research on EAD design and marketing, case studies of current EADs and interviews of key persons in industry will be conducted in order to validate and support the thesis topic.

Limits

The research will be limited to the marketing techniques within the United States of America. There will be a focus on American consumer habits and marketing methodology. Marketing has many social, cultural, and economic influences and it would be unrealistic to research and include international marketing styles.

However, product design has been influenced by both American and international culture. Almost every American product has been influenced by designs outside of America. America is a melting pot of cultures, which can make it challenging to develop an approach that

is purely “American”; therefore, international influences on American marketing methodologies will be included.

1.7 . Procedures and Methodology

In order to create a thorough study about product design and marketing techniques, a significant amount of information will be researched, collected, and analyzed. This information will then be used to create an approach to a well-designed EAD with attributes needed in order to achieve commercial success.

Specifically, in this study there will be case studies on different existing EADs that compile the marketing techniques and characteristics that contributed to the EAD success or failure. The marketing research will be analyzed to determine characteristics that create exceptional user experiences.

The following list explains how each procedure will help collect and explain the data needed for developing the study.

1) Research will be collected through literature, lectures, online articles, and interviews.
    a. Products
        i. Design
        ii. Technology
    b. Marketing
        i. Advertising
        ii. Brand loyalty

iii. Trends

c. Consumer Psychology

i. Brand trust

ii. Pricing

iii. Desires

iv. Needs

2) Define deliverables through conversations with advisors, professionals, and review of existing literature.

a. Research

b. Interviews

c. Case Studies

3) Identify successful and unsuccessful trends and characteristics. Combine research with case studies of characteristics, features, price points, sound quality, color, and brand loyalty.

a. Wall mounted CD player – Muji

i. Well-designed, good marketing

b. Clip Jam MP3 – SanDisk

i. Poor design, good marketing

c. Zune HD - Microsoft

i. Well-designed, poor marketing

4) Create a guideline to assistant the reader in designing and marketing an EAD.

1.8. Anticipated Outcome

Throughout this research, information will be collected that will support the successful design and marketing of an EAD. Too often, designers and the marketing team create a product that fails to include adequate research of the market or provide sufficient design knowledge, resulting in an unsuccessful product with poor ROI. The partnership of the design and marketing teams is essential to produce a high quality, effective and commercially successful product.

Through this research, there will be a design discovery of suitable combinations of product and visual semantics, aesthetics, and functionality. The study will identify key points for successful marketing tactics, how to target archetype consumers and achieve their needs and desires. This research will also shed light on how to advertise EADs to different consumer groups. The data gathered from a range of interviews will help elucidate the thought process behind the purchasing of EADs such as the consumer's lifestyle, purpose of use, and brand loyalty.

Long-term, information will be gathered to improve the user's experience, lower energy waste within companies, reduce environmental pollution, and market products efficiently and effectively to the consumer. The result of the completed study will be a defined approach for designing EADs and a strategy to successfully market them.

1.9 . Literature Review

1.9.1. Introduction

This chart below, "Does this Approach Apply to your Electronic Audio Device" was developed to explicitly define what is considered an EAD to this study and approach. The designer can use this chart to determine whether or not the EAD concept and development can be

paired with this approach. EADs that are used for commercial use such as concert venues are not applicable to this design and marketing approach. Furthermore, products whose main function is not to play audio, such a cellphone (communication) also fails to qualify as an EAD.

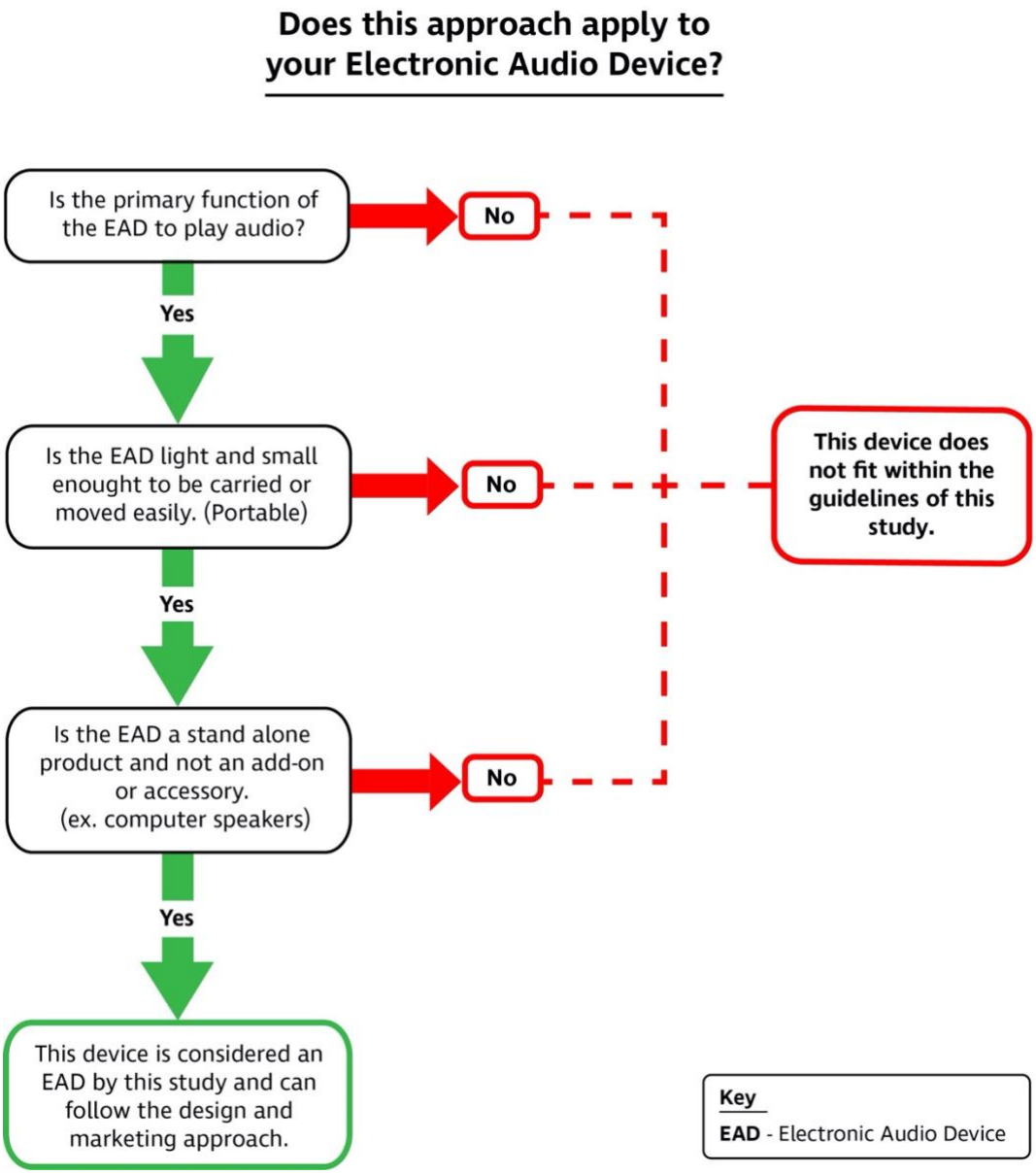


Figure 5. Defining an EAD

EADs include products such as record players, tape players, personal speakers, MP3 players, CD players, radios, and Smart Home devices that can function with or without an

intermediate device such as a smart phone. There are various design factors such as size, color, physical and visual semantics, technology, and materials that when combined thoughtfully, can create an exceptionally designed product. Throughout the study, when describing the user's desires the descriptions will include sound quality, durability, volume range, pricing relative to value (fair pricing), aesthetic, appropriate features, visual affordance (user friendly), and portability. Describing the needs of an EAD will include technology/media compatibility, the ability to play the audio, levels of portability, and universal energy source.

1.9.2. Overview

A commercially successful EAD relies on good design and skilled marketing. There are a multitude of everyday EADs that people use around their home or while traveling. These include devices such as record players, tape players, CD players, radios, MP3 players, and personal speakers. The important harmony of a well-designed product partnered with effective marketing produces a product that is likely to create a high-quality user experience that meets the user's needs. Additionally, the marketing and design team can create a durable product that builds brand loyalty and trust among consumers.

A successful EAD, or any other product, must meet both the user's desires and needs. Their needs can be simply defined as a product that has the ability to play audio when requested, i.e. a CD player needs to be able to play a CD. Their desire may be that it offer visual affordance or simple aesthetics. Overall, a design and marketing strategy needs to blend the consumer's needs with their desires in order to create a well-designed and profitable product that people want to buy and use.

The consumer has an inherent insight into what they enjoy in a product. They experience great design and poor design in products every day, whether they consciously know it or not. Often, when there is confusion or misunderstanding with using a poorly designed product, the user blames themselves. Don Norman (2013) explains this concept in *The Design of Everyday Things*. He describes how the users are apt to blame themselves instead of the designer/product for interface failures. He states, "Because everyone perceives the fault to be his or her own, nobody wants to admit to having trouble. This creates a conspiracy of silence, where the feelings of guilt and helplessness among people are kept hidden" (p.59). Everyone could be having the same problem but because of the silence and lack of discussion over a product, consumers tend to blame themselves for self-perceived mistakes. Norman (2014) describes this phenomenon of self-blame as "Learned Helplessness". This concept additionally describes users that give up on trying to understand the product.

A simple example of a good design can often be seen when one is out shopping. Two shoppers might be looking for something different than each other, but overall their needs and desires often overlap. People buy products or services to satisfy one of two main needs, one, the need to avoid pain or loss, and two, the need to gain pleasure. Well designed and well marketed products tend to entice these needs (National Association of Sales Professionals, 2017). In stores, when a consumer is looking at a row of similar products, they are likely drawn to the most attractive and helpful looking product. This is not a coincidence, because the well-designed products have the factors and characteristics that draw in consumers and satisfy their needs, bring them happiness, and provide a valuable experience.

1.9.3. Defining a product

A product can be as high tech as a car or as rudimentary as a spoon. In a lecture, Richard Buchanan (2011) (a professor of design, management, and systems, and previously head of the Carnegie Mellon school of Design) expresses three common characteristics that all good products have. One, the product has the ability to be useful, two, to be useable and understandable by users, and three, to be desirable and wanted. A well-designed product fits in the center of those three characteristics.

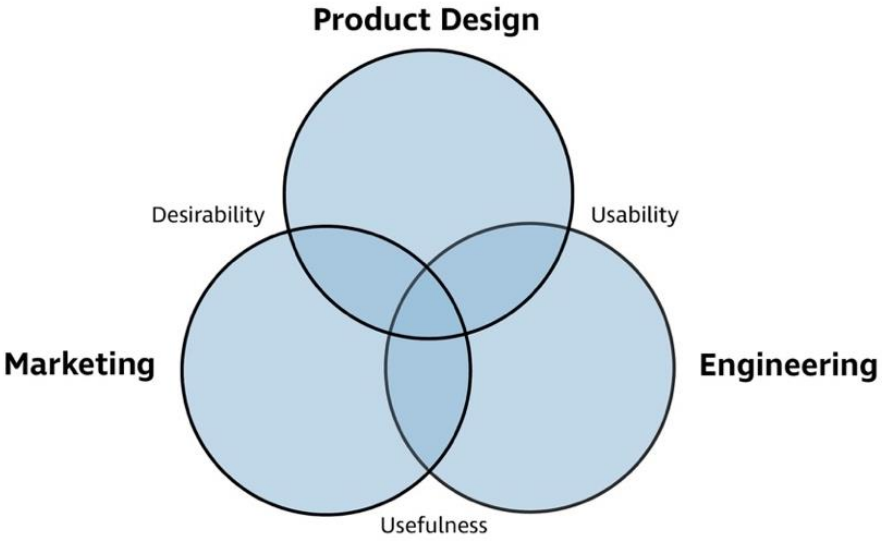


Figure 6. Design Research and the New Learning (Referenced from Buchanan, 2011)

A successful, quality product must not only involve design, but detailed research of the market and a strategic marketing plan. In the article, “Wicked Problems in Design Thinking”, Buchanan (1992) explains what different professions focus on when developing a successful product:

> Industrial design tends to stress what is *possible* in the conception and planning of product; engineering tends to stress what is *necessary* in considering materials, mechanisms, structures, and systems; while marketing tends to stress what is *contingent* in the changing attitudes and preferences of potential users (p.20).

A designer can create a well-designed product, but it must be paired with market research to learn the consumer's changing needs and desires to create a quality product that can be commercially successful. Through this collaboration, the company and product team have knowledge of emerging trends, understand the consumers' needs and desires, and recognize the overall ecosystem the product is joining.

1.9.4. Good Design

To stay consistent in defining and referencing "good" or "quality" design, this study is using Dieter Rams' 10 rules of design (2009). The following section defines good design using Rams' 10 Principles of Design. Each of his statements are followed by more in-depth commentary explaining the quotes (Rams, 2016). The principles cover many different topics but are the guidelines this study will use when referencing a "good" or "quality" design.

1) Good design is innovative

The possibilities for innovation are not, by any means, exhausted. Technological development is always offering new opportunities for innovative design. But innovative design always develops in tandem with innovative technology and can never be an end in itself.

New innovations will always be possible with the developing discoveries of technology. New technology and functions lead to new forms and products. A new EAD product should bring innovative technology to the design and include technology features that the consumer wants.

2) **Good design makes a product useful**

A product is bought to be used. It has to satisfy certain criteria, not only functional, but also psychological and aesthetic. Good design emphasizes the usefulness of a product whilst disregarding anything that could possibly detract from it.

A product must be predominantly functional. Additionally, the form should not distract from the product but work in harmony with the function. If anything is extra in function or aesthetic is on the product, it should ultimately be removed. The EAD market is flush with similar designs and for good reason as the general form of an EAD or other electronic devices are made to fit in pockets, be handheld, etc. EAD design innovation here will be challenging but the reward for an innovative idea here could be quite impactful.

3) Good design is aesthetic

The aesthetic quality of a product is integral to its usefulness because products we use every day affect our person and our well-being. But only well-executed objects can be beautiful.

The form should follow function. With this in mind, the creation must be beautiful. A product should be enjoyable to view by the user. The consumer should feel no shame or discomfort if the product is out on a counter to be seen by guests. For example, the EAD, Google iHome Mini marketing research team determined four colors for their archetype American consumer. Two neutral colors, grey and black, blend in well with a kitchen (typically silver appliances) or an

entertainment room (classically darker colored equipment). Then the trending colors of the season, teal and coral, would shine in a neutral colored room or fit within a user's colorful rooms (Apple Inc, 2020).

4) Good design makes a product understandable

It clarifies the product's structure. Better still, it can make the product talk. At best, it is self-explanatory.

It is okay if a product has basic instructions, but it is unacceptable if a product needs an exhaustive amount of explanation to use it. This results in a product becoming unusable, useless, and eventually wasteful. Given the ubiquitous nature of the EAD and its daily use, an easy to use, self-explanatory design is critical for success in EAD design. Use of universal iconography and intuitive functions will go far in making the EAD successful.

5) Good design is unobtrusive

Products fulfilling a purpose are like tools. They are neither decorative objects nor works of art. Their design should therefore be both neutral and restrained, to leave room for the user's self-expression.

The product should be universally appreciated and does not clash with consumers taste or style. A designer should not put their personality in the design of the product. Incorporating this concept in an EAD design can be difficult as the line between a unique, stylish product and one that fits the consumers individual tastes can be very tenuous.

6) Good design is honest

It does not make a product more innovative, powerful or valuable than it really is. It does not attempt to manipulate the consumer with promises that cannot be kept.

The designer should be honest to the consumer with what the functions and features the product is delivering. This honesty needs to be apparent through the visual affordance, iconography, and marketing.

7) Good design is long-lasting

It avoids being fashionable and therefore never appears antiquated. Unlike fashionable design, it lasts many years – even in today's throwaway society.

Designing a product around the current trends and fads of society results in a product becoming outdated and irrelevant. It will appear to be useless and even be a "gag-product" to look back on in a decade and joke about. This is a key part of creating a lasting product.

8) Good design is thorough down to the last detail

Nothing must be arbitrary or left to chance. Care and accuracy in the design process show respect towards the user.

Every aspect of a product should be thoroughly thought out and analyzed. Every material change, part line, graphic, knob, and so on should be chosen in order to aid and improve the user experience.

9) Good design is environmentally friendly

Design makes an important contribution to the preservation of the environment. It conserves resources and minimizes physical and visual pollution throughout the lifecycle of the product.

Products should not be created with planned obsolescence. They should be made with the best or most appropriate technology and material available. This combats the disposable mentality and ultimately saves the consumer time and money. Using less resources creates less waste and in turn, decreases environmental damage over time. The EAD design should consider this carefully as the e-waste has potential to be substantial depending on the lifespan of the product and ability to recycle and reuse components of the EAD.

10) Good design is as little design as possible

Less, but better – because it concentrates on the essential aspects, and the products are not burdened with non-essentials. Back to purity, back to simplicity.

Design should be intentional and not excessive or an afterthought. Anything that does not improve or benefit the user experience with the product should be removed. Personal audio preferences are as varied as the population is, so EADs have to be designed so that they meet the needs and desires of the consumer but can be appealing to a larger group and therefor they will fit in with several target groups.

1.9.5. Brief Overview of EADs

Throughout history society has enjoyed live music. In the late 1800's music and entertainment became truly customizable and personalized as new technology allowed anyone to record, produce, and listen to audio in their own living room. The first device to be used by the everyday person was Thomas Edison's phonograph in 1877. The phonograph recorded and played back music, as well as famous leader's speeches, comedy sketches, poetry, and

educational lessons. The phonograph made recording audio and mass production of the recordings feasible and helped spread knowledge directly to the people. Edison helped introduce the at home audio and music experience to the common man. With the production of the phonograph, consumers could listen beyond the limits of live performance. There was new-found autonomy for the consumer in the audio and music industry (Thompson, 2016).

Figure 7. “Thomas A. Edison Home Phonograph” (Icollector.com, n.d.)

Figure 8. “Columbia Cylinder Cartons” (tinfoil.com, 1998)

Edison’s design used the best material and technology available to him at the time. The cylinder cartons for the phonograph were imbedded in a long-lasting wax which are now over a hundred years old but still playable today. The sound and product quality can be comparable with some of today’s products.

Phonographs created a new market of personalized entertainment. Since then, numerous new products followed, including the gramophone, the portable radio, record player, portable 8-track tape, audio cassette, CD player, MP3 player, and most recently streaming devices such as smart home devices. All of these products built upon the user's desires and needs and infused new technology advancements into the market.

In each decade, American households have been upgrading and purchasing new technologies, including EADs. According to TechCrunch (2016), 91% of Americans listen to music weekly. Spin (2015) states that American consumers on average listen to four hours of audio every day. Additionally, Saad/Gallup Inc (2014) states that in 2014 over 50% of these music listening Americans have some type of MP3 player or a personal music playing device. The popularity and frequency of use of personal EADs has influenced society through the personalization and the wider selection of audio available to include music, books, podcasts, and more.

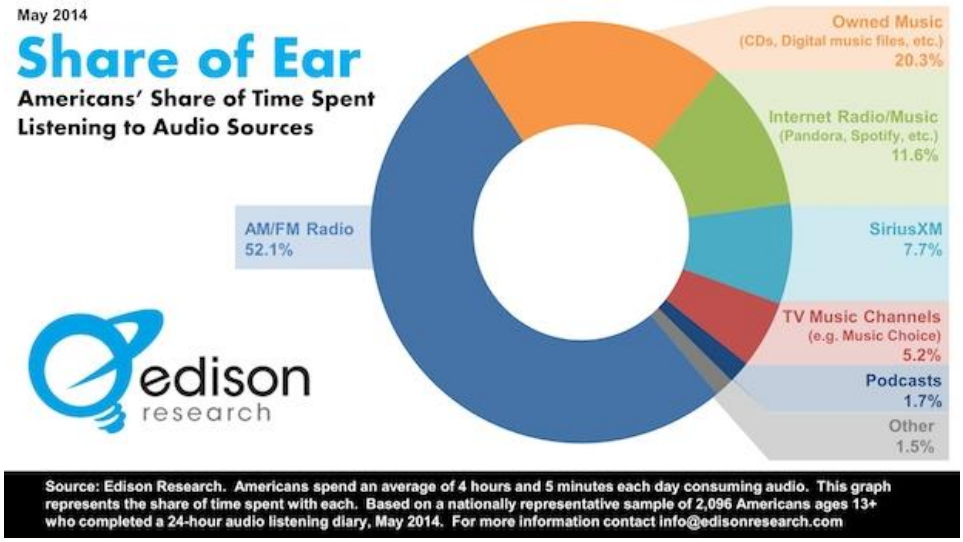


Figure 9. "Americans' Share of Time Spent Listening to Audio Sources" (Spin.com, 2014)

Over the years internet audio and streaming has grown market share through increased use of smart phones, Smart Homes, YouTube, podcasts, and other streaming services.

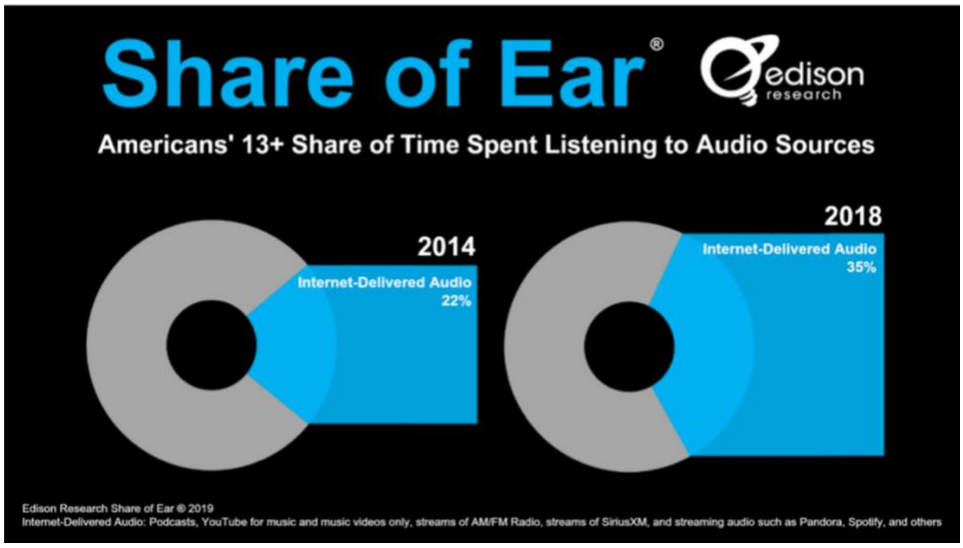


Figure 10. "Americans 13+ Share of Time Spent Listening to Audio Sources" (Spin.com, 2019)

Each of these successful marketing advances in EADs was pushed by the rise of new technology as well as the evolution of consumer's desires and needs. For example, the Sony Portable Walkman CD player was developed after the cassette player series (Jamie, 2018). The Walkman was an evolutionary product that incorporated evolving technology and audio portability to the everyday person. The CD player improved upon the portability, song control, and sound quality of the cassette. These aspects of the handheld CD player gave the consumer the ability to precisely select songs and maintain portability.

In present day, EADs need to include features of past products that consumers still desire while continuing to improve these features and adding new ones as well. These improved features include, portability, sound quality, reduced size and weight, music storage capacity, and song control. In order to be successful, modern products cannot take a step back in technology, quality, or features.

1.9.6. Influence of Marketing

Marketing is a necessary tool to keep products relevant in retail, support the brand's ecosystem, and retain customer loyalty. The goal of marketing is to promote and sell the product through consumer research and advertising. Products can be well-designed, but if incorrectly marketed, the archetype consumer may dislike its features, capabilities, and ultimately fail to build a connection with the brand. The product will have a short lifespan in the market and the company will have a poor return on investment and ultimately lose the consumer's brand loyalty for other products.

An example of quality design but poor marketing can be seen with the Zune HD, an mp3 player, released in 2009. The Zune HD was Microsoft's attempt at competing with Apple's iPod series. Unfortunately, due to poor marketing decisions and lack of consumer research, the production of the device was short lived and ultimately discontinued. The Zune's marketing strategy did not convince the consumer to trust and believe in Microsoft's new product and its ecosystem. TechCrunch stated in 2009 "…at this moment, the Zune HD is the best-looking media player on the market." Many experts agree that the Zune HD was a better design than the iPod touch even though the iPod was the more successful, impactful product. Additionally, the retro review from Windows Central commented almost ten years after the Zune's release, "It's hard to fault the Zune HD as a piece of tech design even now. There are worse looking smartphones being sold every day".

In contrast to the Zune, the brand Coca-Cola can be seen masterfully marketing their product. It is common knowledge that sodas are not beneficial to one's health, but Coca-a-Cola skillfully connects to their consumers through their research and creates a memorable

advertisement strategy that draws consumers into their brand and product. Regarding Coca-Cola's branding, Nettle (2005) states:

> People are fascinated by the idea of happiness, and will follow any system that seems to promise it... systems for living that are actually promising something else, like flow, solidarity, or autonomy, often have to sell their product on a happiness ticket as a marketing ploy (p. 169).

Consumer trends come and go with time. Therefore, it is imperative that the marketing research be thorough and frequent in order to keep up with consumer's changing interests. Market research must also be prepared for new and disruptive products. For example, the smartphone has replaced hundreds of EADs and changed the way people go about their everyday life. Without successful marketing, products can enter the market and be completely overlooked, forgotten, and cause grave financial damage to the company and the brand.

Effective marketing educates and explains to the consumer what the product's function is, why it is desirable, and where you can find it. Few products, even well-designed ones, will have a long shelf life in stores without thoughtful marketing. With effective marketing, a well-designed product can merge into the current product market, become competitive, and rise to commercial success. The designer Fukasawa (2018) supports the importance of the ever-changing marketing environment by stating, "My (Fukasawa) designs come about, not through a focus on the objects themselves but rather their place in the dynamic ecosystems of places and things" (p.9). Marketing bridges the understanding of the ecosystem, culture, and community of a product to the consumer.

Despite the evidence supporting the need for effective design and marketing strategies, some products are still successful without either. Markets are not completely predictable; thus, unexpected results occasionally do occur. Social trends can make poorly designed and marketed products successful. For example, Smirnoff Ice beer is mainly purchased to be used as a part of a prank to play on friends. This consumer group does not purchase the product because of its good design or flavor (Goodman, 2010). It is popular with the young adult community and in 2010 The New York Times described it as “the nation’s biggest viral drinking game”. A product or service can be mediocre, but still be popular due to cultural phenomenon and unusual circumstance.

1.9.7. Marketing and Business Principles

In order for a business to be successful, they must understand what key actions must happen in order for the business to function every day such as: production, problem solving, or supply chain management. Once the business understands the entire cost structure within the business, they can produce and sell products (Channel, 2016).

With the company functioning soundly, the focus switches to the design and marketing of the product. Four fundamental elements make marketing successful: the product, price, placement, and promotion. First, the product should be well designed and fit the user’s need and desire. Second, pricing should capture the production costs and be roughly comparable to existing products. Additionally, the pricing should be appropriate to the market expectations; otherwise the consumer may doubt the products quality or if it is priced too high, may be out of reach for the archetype consumer. Third, product placement should be in stores that fit its purpose and be easily available to the everyday consumer. Lastly, the promotion and advertising

for the product must clearly communicate the product's purpose, features, perks, and price. The promotion must also persuade the consumer that they need the product to be happy and improve their quality of life, which compels them to purchase it, a concept explored further in Chapter Two (James, 2012).

1.9.8. Goals of Thesis

The goal of this thesis is to be able to assist and guide someone trying to design and market an EAD. The collective research, case studies, and interviews will be useful as reference to support the approach. The approach will not only enable a successful product to be developed but it will allow the design to improve the consumer's user experience and combat the throwaway culture, thus creating less harmful waste for the environment.

Furthermore, the approach will expose trends, technology, and features that are universally appreciated by the consumer. Consumers are attracted to certain aspects of design that transcend changing technologies, societal fads, and the economy. For example, consumers are naturally attracted to a product with easy-to-use features, a cohesive form and color palette. Designers and marketing teams need to understand which aspects of design and advertising the archetype consumers are attracted to and how to implement them, as well as understanding the placement of the product, how to price it, and effectively promote it.

Norman (2002) States, "Visibility indicates the mapping between intended actions and actual operations" (p. 8). Every EAD should be intuitive through semantics and visual language. With "good" design, the visual semantic cues can communicate the quality, purpose of use, and features involved. Marketing will help educate the consumer on the product, its detailed purpose, where to find it, and its value. Marketing gives the physical product a voice and explanation. An

effective company needs designers and marketing teams in order to create commercially successful products that meet and surpass the consumer's expectations.

Chapter Two

Case Studies

2.1. Introduction

This chapter will include three case studies focusing on different EADs: The Zune HD, SanDisk Clip Jam, and the Muji wall mounted CD player. The Zune HD was a portable media player released in 2009 by Microsoft. The design was superior to competitors, but due to poor timing and marketing it was discontinued. The SanDisk Clip Jam is a portable media player and was more recently released in 2016 by SanDisk. It is not ground-breaking in design, but with effective marketing to target the archetype consumer the product is still selling successfully. Lastly, there will be a focus on the Muji wall mounted player designed by Naoto Fukasawa in 1999. This product has been "modernized" by adding technologies like Bluetooth capability. Other companies have created imitations of the design, which could be seen as a sign of flattery, but for this study the focus will be on the original Muji product. The Muji wall mounted CD player was both was designed and marketed to consumers skillfully.

Reviewing these products will illustrate different aspects of both strong and poor design and marketing. By breaking down the range of challenges and approaches these products and brands have experienced, these case studies will demonstrate what aspects of design and marketing can make an EAD commercially successful.

	Marketing	Design
 SanDisk Clip Jam MP3 Player	✓	✗
 Zune HD MP3 player	✗	✓
 MUJI's Wall-mounted Compact Disc Player	✓	✓

Table 2. Visual Summary of Case Studies Product

2.2. Zune HD

2.2.1. Introduction

In this review of the Zune HD there will be an analysis of the product, the design, Microsoft's marketing, competitors, and technology. The Zune HD was an extremely innovative and advanced design and was paired with an audio subscription service. Unfortunately, the product struggled to compete in the marketplace and was eventually discontinued.

Figure 11. Zune HD (amazon.com)

The second generation of the Zune was the Zune HD. It was released in 2009 by Microsoft, but by 2011 the Zune series was permanently discontinued. It was a direct competitor with Apple's iPod and iPod touch series. Users enjoyed the interface and audio quality as much as the iPod if not more; examples will be referenced later in the study. It had an OLED touchscreen for user navigation, Wi-Fi, and two different variations that could hold either 16GB or 32GB of music files. As a result of joining the industry late, consumers perceived the product to be "not as good" or worth their time to explore purchasing. Many of the users were invested in other MP3 products. Overall the Zune HD was very well designed but lacked some innovations and had insufficient marketing (Damra, 2017).

The first version of the Zune media player was released in 2006, five years after the first iPod product was released. When the Zune HD was released, the iPod Touch had already been out for two years. Apple already had a strong hold on the market and practically had a monopoly. Most consumers already owned an iPod or some kind of Apple product and there was no apparent incentive for the consumers to switch to a different product.

Additionally, Apple had developed an ecosystem with their products and services. By 2010 Apple's product line included the iPod, iTouch, iPhone, iTunes, MacBook, iPad, and Apple TV. Once the consumer purchased one product, it encouraged the consumer to collect more (Alba, 2016). There was a known familiarity and trust with their other products. Even in 2019 many consumers remain deep within Apple's ecosystem for a multitude of reasons, but mainly because the fear of change and time to it would take to learn a new system (Rathi, 2018).

This notion is reinforced by iTunes, an online digital media store that opened in 2003. iTunes could traverse between different products and share music, TV shows, films, Apps, podcasts and more with the user. With iTunes, consumers were purchasing their media, building

up their collection and ownership with the brand. It represented their time, resources, and personality. Switching to a different service would result in a waste of their efforts and money and the loss of all the media they had been collecting, which represented several years of effort in many cases. At the time, American consumers preferred owning their media because that was the shared norm, unlike the subscription style service offered by Microsoft. Microsoft's subscription service model did allow the user to build up their collection faster and with less cost, but again it was too "new." In the article "The Rise of the Subscription Society" by Mike Branton (2019), the main takeaway relative to the Zune HD is that online and digital subscription services didn't reach commonality and convenience until the early 2012, as the Zune HD production ended.

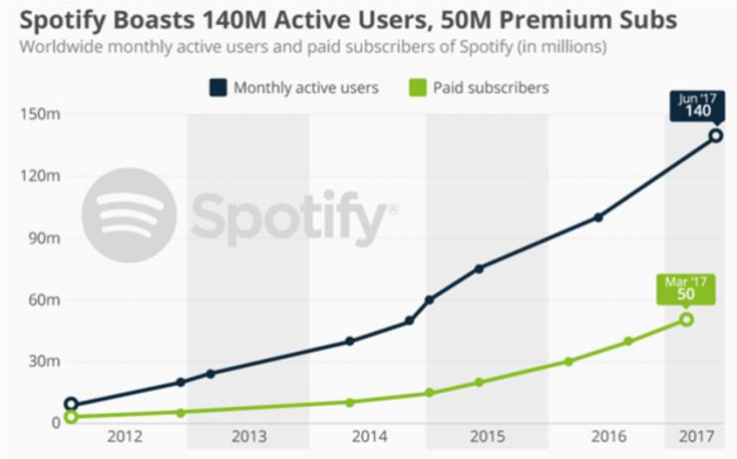


Figure 12. The Rise of the Subscription Society (bankdirector.com)

This chart is just one of many listed in the article about online subscription services. Spotify is a music subscription service that really achieved success in 2012. This contrasts with the release of the Zune HD in 2009 and its demise in 2011.

2.2.2. Statistics

	Zune HD	iPod Touch (2nd Gen)
Availability	September 15, 2009	Now
Storage	16GB | 32GB	8GB | 16GB | 32GB
Price	$220 | $290	$229 | $299 | $399
Display Size	3.3 inches (OLED)	3.5 inches
Display Resolution	480 x 272 pixels	480 x 320 pixels
Dimensions	Width: 2.07" Height: 4.08" Thickness: 0.35"	Width: 2.4" Height: 4.3" Thickness: 0.33"
Weight	Unspecified	4.05 ounces
Wi-Fi	Yes	Yes
Bluetooth	Unspecified	Yes, with A2DP
Radio Tuner	HD Radio Tuner	No
Accelerometer	Yes	Yes
App Store	Zune Marketplace	Apple App Store
Web Browser	Internet Explorer Mobile	Safari Mobile

Figure 13. Zune HD vs iPod Touch: Feature Smackdown (PCWorld.com, 2009)

As shown in the figure above, the Zune HD is similar to the iPod Touch or better in the performance traits listed above. Although not stated in the comparison chart, the Zune HD's weight is 2.6 ounces, about 1.5 ounces less than the iPod touch. The Zune HD is slightly more compact than the iPod touch (Bell, 2009). The most important takeaways are the price difference for the storage size. The cost of the Zune HD (16GB) was $220. In contrast, the iPod Touch (2nd generation) was $229 and held half (8GB) the memory of the Zune HD. As well, the screen allows for a more user-friendly interaction. In the article, "Zune HD made me Wish I Never Bought an iPod" there was a statement,

> The Zune UI feels thoughtful, based on gestures rather than taps. Sure, Apple pushed multi-touch from the launch of the iPhone, but you still had to tap and tap and tap to do everything. The Zune HD just flows. (Devine, 2017)

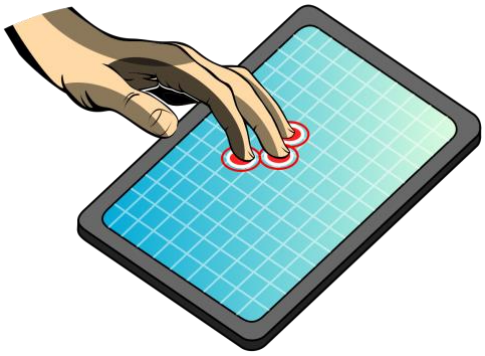


Figure 14. Touch (Clipart-library.com)

The OLED screen allows for smooth, natural movement of the hands on the screen compared to the pressure touch screens prevalent in the iPod devices. OLED was thinner, lighter, and more flexible than the crystalline layers in an LED in the iPod Touch. In summary, the Zune was lighter, smaller, made of higher quality material (Aluminum) and it included new technology like the OLED screen.

The Zune HD has three inset buttons on the form. One is the control button for turning the Zune on and off. Two identifies the location for a quick tab of volume and audio. Three is the home button that returns the user to the homepage, well as the "wake up" capability once the screen has dimmed or gone into sleep mode. Within the design and interface of the form the button labeled number two has had the most design complaints. Once selected, the audio selection screen pops up and it visually and physically blocks the user from being able to do

anything else or see behind it. The location of the volume/play button, labeled number Two, is in a comfortable, ergonomic location when selecting it, but again blocks the user from doing anything else and the user has to wait for it to fade away. The “click away” option is a small exit button, but it is small and difficult to select properly. Once the button is missed, it keeps the volume/play tab open even longer. This discourages users from even trying to hit the small “exit” button.

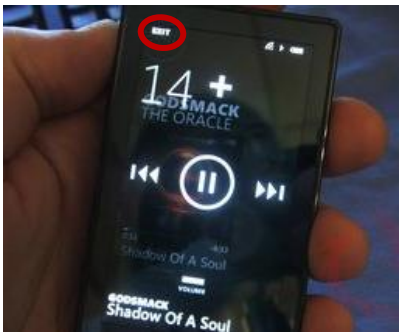


Figure 15. Left - Zune HD UX One (windsowscentral.com, 2017)
Figure 16. Right - Zune HD UX Two (windsowscentral.com, 2017)

Another design grievance is the power cord functionality. The design was typical of the time, but does not match the excellence of the rest of the Zune HD. There are side buttons and internal hooks to lock in the charging cord into the Zune HD. In theory this protects it when dropped and prevents it from coming unplugged. In practice it made it difficult for the user to plug and unplug their product, sometimes even damaging the charging port due to yanking, pulling, and jerking the cord around.

Figure 17. Zune HD UX Three (aliexpress.com, n.d.)

Finally, within the marketplace system, consumers were disappointed with the lack of Apps and games. Windows again was five years behind Apple's products and did not have the same infrastructure to support Apps and games. "It is hard to fault the Zune HD as a piece of tech design even now. There are worse looking smartphones being sold every day, and the Zune came to market eight years ago" (Windowscentral.com, 2017).

2.2.3. Service

Microsoft had an online media store as well, called the Marketplace to compete with the iTunes store. The service was a little bit different than iTunes. Instead of permanently owning the music and paying for each song the Marketplace was a subscription service. There was a monthly payment of $15.00 and in return the user could download an unlimited amount of music and permanently add 10 songs to their collection each month. In general, the purchase of other media like TV shows required a separate payment. The built in Wi-Fi allowed the user to download media from any location. The Marketplace was also notably lacking in Apps. There were only approximately sixty in total, which was miniscule compared to iTunes service which offered hundreds.

Perhaps the major blunder was the fact that, if the user wanted to switch over to a different product or system, their media would not transfer. Specifically, if the user had an iPod touch, they would have to do detailed research on their own time to learn how to transfer data from their iPod touch to their Zune HD. The process was not easy or intuitive as the user had to change the iTunes audio format from AAC to MP3 files in order to load them onto the Zune. The process was unknown to the everyday MP3 user and the ones who tried it also found it to be a challenging (Amy McNulty, N.D.).

Service: iTunes (iPod Touch) → Marketplace (Zune HD)

Audio File: AAC (iTunes) → MP3 (Marketplace)

The end result was that the user would lose the majority of their media if they switched products, which significantly hindered sales (Preston, 2006).

2.2.4. Internal Components

The way the Zune HD was designed allowed it to be taken apart and repaired if needed. The back is removable in order to repair parts such as the battery instead of needing to replace the device as a whole. It allowed for a longer lasting product and reduced e-waste because the Zune's design allowed the user to have control over the internal components.

Figure 18. Left - Zune HD UX Four Left (amazon.com, n.d.)
Figure 19. Right - Zune HD Tear Down (cnet.com, 2009)

This feature may have decreased the overall Zune HD sales however, as consumers may have repaired items rather than purchase new ones. There was not a detailed study released to the public on the number of sales and Zune HD repairs, due to the limited period of sales, but assumptions can be made that sales were lost due to repairs. Most Apple products did not allow for that kind of accessibility or made it challenging, due to their marketing strategy. There is the

balance of sales, user experience, and environmental concerns that must be accounted for in the overall strategy. Apple took away the user's autonomy over the product to, in short, build a higher revenue stream and avoid the possibility of the user damaging a product. The user either has to go to a specialist at the Apple store to diagnose the problem or replace the product as a whole, which both contribute to Apple's bottom line.

2.2.5. Marketing

From a marketing perspective, Apple's advertisement for the iPod were spot on. Even a decade later, iPod advertisements are still identifiable. In the advertisements there are vibrant colors, silhouettes of people dancing, and the white shapes of the iPod. The decision to keep the people faceless and shadow-like lets the viewer put themselves in the advertisement: anyone could be using the iPod. Keeping the person anonymous removes visual distractions of gender, race, nationality, clothing styles and more. Apple advertising is seen as clean, memorable, and relatable, and it communicated to the consumer that they needed this product to be happy. Contrasted with this, Microsoft's advertisement was typically cluttered, overzealous, and misrepresentative of the product's identity (Cuneo, 2007).

Figure 20. Apple iPod Ad (smartworld.it, 2016)
Figure 21. Microsoft Zune Ad (istartedsomething.com, 2007)

2.2.6. Conclusion

In conclusion, the Zune HD was a well-designed product but joined the market too late and suffered from poor marketing. The product was discontinued due to flat sales and lack of strategies to combat Apple's empire. Paired with lackluster marketing, the Zune HD was not enough of a standout product to capture market share by convincing consumers to leave the Apple ecosystem. Edgar Kaufmann states, "People take pride in making and owning the best design of their times" (Gorman, 2003). In 2011 at Apple's "Let's talk iPhone Event" there was a simple but impactful chart that compared the iPod's sales with others. In the US alone 78% of Mp3 player sales were iPods and 22% were the competitors. In the same year, Microsoft retired the Zune HD media player only a few years after its release (Macale, 2011).

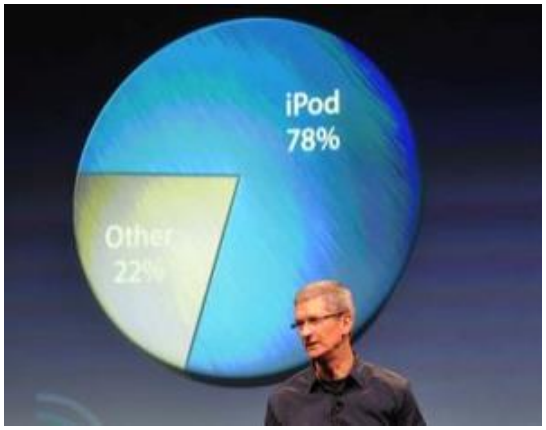


Figure 22. Apple Music player Market (thenextweb.com, 2011)

2.3. SanDisk Clip Jam MP3

2.3.1. Introduction

In this review of the SanDisk Clip Jam MP3 player, there will be an analysis of the product, the design, marketing techniques, and technology. The SanDisk Clip Jam is not an outstanding design per se, but through superior marketing and consumer research targeted a specific group of

consumers and successfully captured market share. The commonality of smart phones began in the 2010's. With this in mind, smart phones began to replace MP3 players. Yet contrary to most assumptions, the MP3 market is actually still thriving. The SanDisk Clip Jam made minimal changes to the basic MP3 player design and functionality but has been able to successfully market the product to a different audience.

The SanDisk Clip Jam is a portable media player that first was released in 2016. The product's goal is to solely play audio files with no focus on aesthetics or other technology features. The product is intended to be inexpensive and consumer friendly. It is small, made of lightweight plastic, and priced at only $30. It has a run time of twenty hours. Additionally, it is almost the same size as the iPod Shuffle, but more inexpensive and overcomes the main complaint of the Shuffle, the lack of a screen (Blanco, 2016).

2.3.2. Background

The Clip Jam when purchased holds 8GB; with the addition of a micro SD card it can hold up to 64GB, which is more than the iPod Shuffle (2GB) and Nano (16GB). SanDisk markets their SD card as consumers are likely to buy the same brand of technology when they need them to interact with each other. This builds brand loyalty, SanDisk's ecosystem, and revenue.

Figure 23. Clip Jam (sandisk.com, 2019)
Figure 24. Clip Jam Side View (cnet.com, 2016)

The product design is focused on mobility. There is a clip on the back to make it easy to attach to the clothing or other items. CNET described the Clip Jam as “no-frills MP3 player for taking to-go” (Blanco, 2016). Unlike most of the MP3 players of the past, the goal of this product is only to play audio and nothing more. The product is even purposely made with cheap material in part to reduce the stress on the user because so many people are carrying around expensive technology-based products. For an example, a smart phone holds an incredible amount a person’s information and can cost over $1,000. If it breaks or is lost, the user can lose a vast amount of information, priceless photographs - not to mention the cost of the phone.

2.3.3. Statistics

There is not a large display screen on the Clip Jam because there are no additional visuals to be displayed such as music videos, movies, or games. The technology and UX is simple, but the product focus on its one purpose of playing music, unlike the smart phone which has mastered all the other facets of this field.

SanDisk’s marketing targets a specific group of consumers who are passionate about music but want to distance themselves from smart technology, are not fervent about streaming, need a larger storage location for their audio, and/or want to combine their music data bank with music already purchased from other sources.

Figure 25. Clip Jam Interface (Forum.lowyat.net, 2017)

The SanDisk is compatible with WMA, WAV, AAC, iTunes, and Amazon music. The user can combine any audio they own without a conflict of interest (Duvauchelle, N.D.). The majority of the audio can be from iTunes, yet they can add audio books from Amazon with no problem and with any audio format. This meets the need and desires of most day-to-day consumers and more. The product also includes FM radio, but no Wi-Fi or Bluetooth capabilities. The main complaint with its technology is the lack of Bluetooth given the growth of Bluetooth headphones (Blanco, 2016). The technology is simplified, but it is designed and marketed towards a different audience who does not desire Smart technology.

CNET created a video describing why MP3 players are still successful in the smart phone era with the clip jam as one of the two supporting examples. The video has almost 150,000 views on YouTube. One of their main points mentions the precious value of smart phones. The fear of a user breaking them while working out or it being stolen or otherwise lost is a critical concern for many consumers. The video references the Clip Jam as an alternative to a smart phone because it is less expensive, less likely to be stolen, and preserves smart phone battery and data. The main feature of an MP3 player is portability, which the Clip Jam achieves in spades. The lightweight plastic makes it easy to move around with and it does not weigh down a pocket. It is

at the lower end of the price scale, making it low risk if it breaks or is stolen/lost. The Clip Jam functions extremely well and is very popular with its target audience (Blanco, 2016).

2.3.4. Clip Jam User Experience Interview

This interview took place in mid-2019 and includes information about the interviewee's user experience with their SanDisk Clip Jam. It supports and informs parts of the Clip Jam case study and then later parts of the approach for commercial success when designing and marketing an EAD. For context, he is educated in the design field and is in the age group later identified in Chapter Four, as 24-year-old to 30-year-old.

Interview

Introduction

1. Why did you buy the Clip Jam?

   "I bought the Clip Jam because I wanted a device for playing mp3s."

2. Why did you not buy other MP3 products (like Apple's iPod)?

   "It was too expensive and didn't want to go through iTunes to get my music. I always forget my Apple ID, and I don't know if I already have an account with Apple or not. I like just going to Amazon and downloading mp3s."

3. Why do you not stream audio or use your smart phone?

   "I don't have a smartphone, so streaming is only an option on my laptop, not on the go. I also don't like paying for a subscription service, which can get pretty expensive over time. It's almost the same cost as a new mp3 album every month. I like the concept of

having a “physical/ digital copy” of the song without having to always connect to the web or go through another service.”

4. How did you learn about the product? Commercial, Internet, friend?

   “I figured there was something like it at Best Buy and went there one afternoon and picked it up.”

5. How long have you had the product? Does everything still work to full capacity?

   “I have had the product for less than a year. It does still work. Right now it is my backup music player behind my flip phone. My flip phone has a speaker and is waterproof so it’s good for listening to music anywhere, out loud or with headphones. The only downside is that it’s hard to run with my flip-phone.”

Details

1. How often do you use the product? When do you use it?

   “I use it sparingly, but I always keep it in my backpack as a backup music player.”

2. What are your favorite and least favorite parts of the product?

   “My favorite part of the product is its simplicity and use of real buttons. It has a retro feel that I like, and there is something satisfying about just clicking the play button.”

3. Do you like the size and weight of the product?

   “Yes, I like the size and weight of the product. It feels like it is the right size, but I think it would be cool if it could get even more compact.”

4. Do you like the clip aspect of the product? Do you use it?

   “Come to think of it, I don’t really use it very much. I usually just put it in my pocket. The only time I would use it would be on an intense run.”

5. Do you like the user interface (UX/UI)? The buttons and screen interactions?

   “I like them ok; the colors and graphics are somewhat cheesy. It gets the job done without distracting me with ads, interruptions, and popups, all with the best audio quality, which is what I want.”

6. Are you satisfied with the audio quality and is that something important to you?

   “Yes, I like the audio quality of mp3 over streaming. It is one of the best features of the device. I also play guitar, so it is great to hear the subtle tones that are lost with streaming.”

7. What do you think about the material of the product?

   “I think it feels pretty cheap. I think they did that to reduce the cost of the device. The screen has tons of small scratches on it because it isn’t real glass. It gives the device a weathered look, but then the overall form doesn’t look very outdoorsy, so it doesn’t fit.”

Future and Suggestions

1. When it is time to replace the Clip Jam, would you buy the same product or try something different? What would it be?

"I would try and find a similar device that was higher quality, but kept the same features, like Bluetooth connectivity, water resistance, etc…"

2. Do you have any other electronic audio devices? Such as a tape player, stereo, smart home, mp3 player?

   "No. This is my only device besides my phone, laptop, and truck."

3. What do you think about the overall design of the product? What would you change or not change?

   "I would try and make the overall form more interesting. I would maybe try to incorporate a cool and fun way to use the product to separate it from other music devices like smartphones. I'm thinking of something like the iPod classic controls, or maybe even a new method. I would make the device as compact as possible, to give it an edge over smartphones with their large displays. I would change the housing material to something more rugged looking and premium feeling. I would also design all of the gaskets to be very durable so that repetitive use didn't break them off. I would try to incorporate a glass or gorilla glass display that was ultra-minimal. I would include a clip with the product but design it in a way to where you can remove the clip if you don't want to use it, sort of like a nice removable knife clip."

2.3.5. Conclusion

In summary the Clip Jam MP3 player is aimed purely towards utility and functionality. The Clip Jam lacks beauty and aesthetic but is affordable. The consumer knows the product is not considerably durable because of the plastic form and lack of current technology such as touchscreens. Applying Dieter Rams' Principles of Design, the product is honest. The consumer

knows what they are purchasing and are content with it. This product is supplemental to a more valuable product such as the smart phone. The product is a successful and well marketed, but visually described as “ugly, a cheap cousin of Apple iPod” (Blanco, 2016).

2.4. Muji Wall Mounted CD Player

2.4.1. Introduction

In this review of the Muji wall mounted CD player, there will be an analysis of the product, the design, marketing methods, Japanese culture, and the designer himself. The Muji wall mounted CD player is a product that was not only skillfully designed but is sold by a very profitable and versatile company. Muji knows how to connect and sell their products to consumers globally.

Figure 26. Wall Mounted CD Player in Context (Muji.com, n.d.)

2.4.2. Background

The wall mounted CD player produced by Muji was designed in 1999 by the internationally renowned designer Naoto Fukasawa. It was awarded the iF Design Award which represents a seal of excellence, quality, and outstanding service to the user. The award declares the CD player is well designed and that consumers should and can trust this product (Faud-Luke,

2010). It is a permanent installation at the architecture and design department in The Museum of Modern Art in New York (MOMA, N.D.). It is still well received and honored over twenty years after its design. Naoto Fukasawa through design and tactful research captured consumers' attention and needs with this EAD.

2.4.3. Statistics

The product comes only in white, lightweight ABS plastic, and contains the standard other electronic components that most CD players contain. It does have a dual function cord that brings electricity to the product as well as providing the on/off button for the CD player. The user pulls down on the cord as they would for a ceiling fan. It is currently (2019) priced at $190 and is 12.5 x 7.5 x 2.7 inches. There are tactile buttons with extrusions on them at the top of the CD player to provide manual control of the product. The extrusions communicate to the user what each button controls without necessarily having to see them, which is excellent design semantics and creates accessibility. The Muji brand is simple and describes their products as "removing unnecessary materials, functional, intuitive, and nearly invisible" (Muji, N.D.).

Figure 27. Left - Wall Mounted CD Player Mount (Muji.com, n.d.)
Figure 28. Right - Wall Mounted CD Player Interface (Muji.com n.d.)

The CD player, as stated earlier, continues to be sold today on Muji's commercial website even though compact discs are seen as an outdated audio media technology. There have been a few technology updates for the CD player including the addition of FM radio, remote control, and a backlit LCD display next to the button control panel. These aspects were added to make the product easier to use and more enjoyable for the consumer. The design and marketing techniques have been carried on through three separate decades (Muji.com, n.d.).

Figure 29. Remote for Muji CD Player (Muji.com, n.d.)

In a 2018 interview, Fukasawa stated the CD player was inspired by the kitchen fan and ventilation system. The audio is in the atmosphere, similarly to how a fan interacts with the air in the atmosphere, moving around. Consumers still see this as a new way to enjoy music and remove clutter from tabletops and floor space. Fukasawa explains that even though CDs are dated technology, people are still buying the CD player because "their lifestyles need it". People are often listening to the same music throughout the day and the wall mounted CD player attracts the consumers of habit as well as consumers who enjoy the innovative design of the product (Ie.edu, 2018).

2.4.4. Brand and Marketing

Muji was founded in 1980 in Japan during the booming Japanese economy of the 80's. Furthermore, foreign luxury brands were becoming more popular as were products on the other end of the spectrum. With these two extremes in the marketplace, Muji saw an opportunity to introduce their products. Muji focused on developing tasteful, affordable, and durable products. In the beginning Muji sold only nine household items and thirty-one food-based products. In 2017 they are a "lifestyle" brand with over 7000 products ranging from clothes to furniture to food. There are 700 stores worldwide and Muji firmly believes 'Less is more' (Annabelle, 2017).

The company's original full name is Mujirushi Ryohin, which literally means "not branded, quality goods" (Bloomberg, 2019). As stated earlier, it is a philosophy Muji aims to keep. Muji wants their products to stand the test of time and avoids trends and fads. This is a large part of why their designs are minimalistic and avoid making a statement with style. Naoto Fukasawa, the designer of the wall mounted CD player, described Muji's products as just 'enough'. Muji wants their customers to feel satisfaction and that their needs are met. Consumers are confident in their Muji products (Annabelle, 2017). Edgar Kaufmann describes the pride people have in their products as, "pride is one aspect of a deep, abiding pleasure which people derive from design (Gorman, 2003).

2.4.5. Production

Alongside Muji's philosophy, they have a set of core principles that helps guide their design and manufacturing, and which keeps their brand identity consistent. This includes selection of materials, streamlining of processes, and simplification of packaging. Muji does not put logos or other gaudy callouts on their products, which ensures their products are all seen as a

cohesive set. Additionally, material decisions create coherence within their wide range of items. The user can pick and choose a variety of products, but they will still match one another, which is why Muji is often described as a lifestyle brand (Annabelle, 2017). These core principles enable Muji to save material, production cost, and create less waste, enabling the products to be priced fairly even given their high quality.

2.4.6. Selection of Material and Streamlining Manufacturing

Muji thoughtfully selects raw materials for their manufacturing and often uses unfinished or natural materials. Muji also uses industrial materials that have been discarded and seen as unusable to other companies. This is either due to the materials' appearance, or that it is flawed in another way that does not match that company's brand or is waste material. This technique allows Muji to purchase in bulk at a lower cost. A specific example of this was seen when Muji sold pasta in a U-shape. The U-shape was seen as unusable to the pasta-based company who only sold straight pasta noodles. The waste did not match with the rest of their brand and product identity. But due to Muji's 'no brand' brand, they were able to capitalize on the seemingly wasted product (Annabelle, 2017).

Muji streamlines manufacturing processes by following their philosophy of doing only what is 'enough'. This is by often accomplished by using natural or unfinished materials, which avoids the cost and time of painting, dyeing, or other alterations to a material (Annabelle, 2017). This process also reduces labor and resources required in the manufacturing process.

2.4.7. Simplification of the Product and Packaging

Similar to IKEA and Uniqlo packaging, Muji uses bulk packaging. Their packages are plain and uniform, which again falls in line with their 'no brand' strategy. Using minimal

packages reduces resources and is cost effective. Additionally, this packaging methodology is environmentally friendly due to the reduction of material used and reducing the shipping carbon footprint. After the 2011 earthquake in Japan, Muji challenged itself to reduce material and energy in each product by 20%. For example, Muji shortened Q-tips and designed a lid that could fit five different sized pots. These products and design change were featured at the Design Museum in London. There are more examples of simplifying products and packaging, but the key takeaway is that Muji is able to create eco-friendly products and continue to build revenue and grow as a company (Muller, 2012).

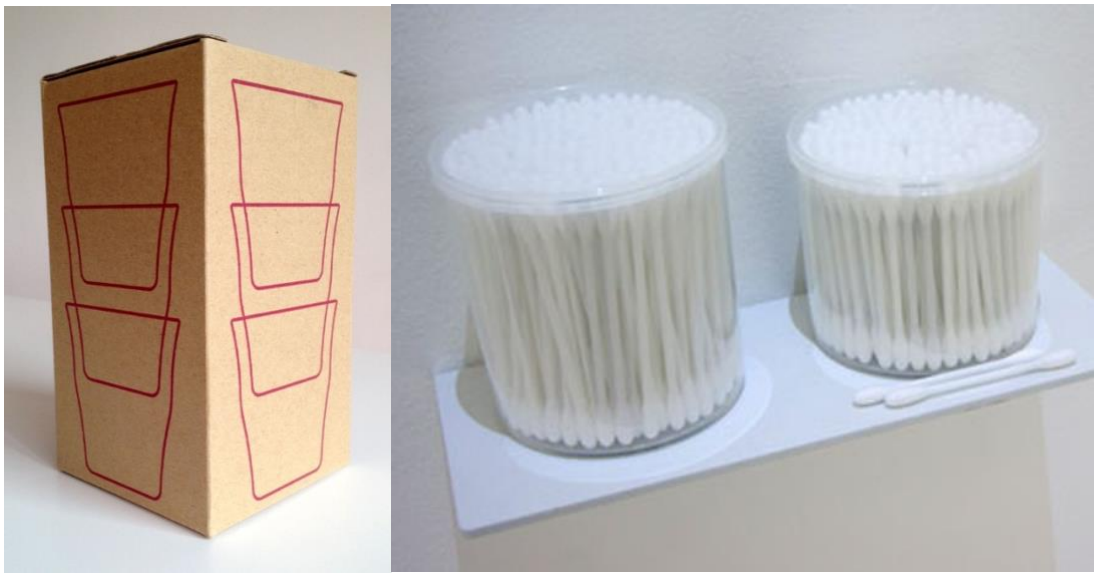


Figure 30. Left - Muji Packaging (Gajdos, n.d.)
Figure 31. Right - How Muji Design Reduces Carbon Impact (Muller, 2019)

2.4.8. Conclusion

Muji has developed incredible brand trust with their simple design and environmentally friendly manufacturing. Muji has grown consecutively over the past four years as of 2018. Additionally, their overseas sales increased by 27% and is expected to grow 10% in China (Ban, 2018), even though there has been a struggle keeping Muji export prices similar to their prices in Japan. A management professor at Hitotsubashi University stated, “In order for Muji to be true to

themselves as a provider of low-priced quality essentials, they have to bring down the price point and make it available to everyone…". Muji is moving production around the world to areas like India and Southeast Asia to produce products at a lower price and are designing products that more closely match other countries' consumer needs in their day to day lives (Bloomberg, 2019). The wall mounted CD player is aesthetically appealing, blends in with households by hanging on the wall, and has a powerful marketing and branding company behind it, which is why it has lasted over three decades even with the advances in technology.

Chapter Three

Interviews

3.1. Introduction

Within this section there is a deeper analysis of how design and marketing coexist in order to create a commercially successful product. There is less focus on specific aspects of EADs and more emphasis on the business, product development, and marketing techniques for products. The professional interviews reveal real world insights into business approaches as well as their methods and approaches for specific circumstances. The goal of these interviews is to better understand professional decision making between the design and marketing departments.

Three interviews were conducted with professionals in the marketing and design fields. The interviewees were asked the same questions with their responses analyzed and summarized. Significant statements, quotes, and callouts were collected and along with the questions asked are listed below for reference. A majority of questions were answered, but some were left blank or were not applicable to the individual's specific position.

3.1.1. Interview Questions

Research

1) What is the process by which new product ideas are generated?

2) What is the process by which design and marketing interface during the new product development process?

3) What types of research are incorporated in coming up with new product ideas and how does design fit into the process.

Design

1) Does the design team meet with the marketing department?

a. If so, how often, and what strategies are discussed?

b. If not, do you think meetings with the marketing team would be beneficial?

2) Does the marketing team play a role in setting objectives for the design team during the product development period?

3) Are there certain topics that create disagreements between the design and marketing teams more often than others?

a. If so, what are the topics and how are they resolved?

b. If not, explain how conflicts are avoided.

Market

1) Does the marketing team meet with design department?

a. If so, how often, and what strategies are discussed?

b. If not, would you see benefits to meeting with the design team?

2) Does the design team communicate important product features during the marketing process?

3) Are there certain topics that create disagreements between the marketing and design teams more often than others?

a. If so, what are the topics and how are they resolved?

b. If not, explain how conflicts are avoided.

4) Does the demand from eco-friendly consumers influence the market or product design?

a. If so, how?

5) Are their conflicts between creating a lasting, green product and meeting the economic expectations of the company?

3.2. Interview One - Vice President of Commercial Design

This is information was collected from a confidential interview with the vice president of commercial design at a computer technology company.

3.2.1. Product Research

The interviewee describes research and development for a new product as "multipronged". Overall the design process is developing the product's values. The interviewee states, "What does the user want and then the company decides on features to deliver".

The interviewee explained how technology-centered product development is thorough and complex due to the nature of technology; it is ever-changing with new innovations. Product research includes the following steps: user research, ethnographies, concept testing, company reactions, and then adjustments accordingly. Once the product enters the market, the company continues to monitor it and the competitors, review the supply chain reaction, and again react and make changes correspondingly. With changes in technology and current problems identified, there must always be a clear solution before implementing a change to the product.

The process by which design and marketing interact during the new product development process is very early and from the beginning. The interviewee stressed how important it was that the product's purpose and story be able to be explained in thirty seconds. Otherwise, the product is not likely to sell to its full potential. Additionally, during development it will not be understood well by the different departments working on it.

Design messages are briefed to the marketing team which combine the product's design, features, and story, and then integrate it into the company's brand. The interviewee explained that at his company there is an established focus group to keep the company's brand and identity consistent throughout the company and their various products. Furthermore, the interviewee's company sells to both brick and mortar stores and to online companies and the company's brand and message must be effectively conveyed in order to advertise it to consumers correctly.

The company participates in trade shows across the US, Europe, Middle East, China, Japan, and in other smaller engagements. The company joins in these shows to see companies', clients', and others' reactions to their early product concepts or product changes and improvements that are planned to be released with the next year or two. The interviewee explicitly mentioned a Japanese company they work alongside with, how important it is for product research to be done in depth, and that it is vitally necessary for the company to communicate with and trust their partner companies.

To summarize, the design research process of this computer technology company includes topics such as design value, competitive studies, worldwide customer engagement, consumer ethnographies, and retail research.

3.2.2. Design

The design and marketing departments meet regularly to go over the "go to market" strategies, but not much else. The marketing team does not play a role in setting objectives for the design team during product development. The mission for the marketing team is to sell what has been designed and communicate the company's brand, story, and goals.

Sometimes disagreements arise between the marketing and design teams with the deliverables, features, and message of the product. The interviewee specifically referred to a product the company released where the advertisement of the product became too focused on fashion and trends instead of the product's goals, purpose, design, and craft.

3.2.3. Marketing

The interviewee explained how the marketing and design team work together and focus on different facets of the product in order to ensure a successful product. The marketing and

consumer departments are dedicated to appealing to the archetype consumers while product planners are more focused on the overall commercial success of the product. The design team communicates important product features to both teams during the marketing process. This allows the marketing team to communicate clearly to consumers why they need the product through customer point of view advertisement stories, visual animations, and design stories calling out features of the product.

3.2.4. Environmental Influence

The demand for environmentally friendly products increasingly influences the current marketing and product design processes. There is now a powerful push for sustainable and recyclable products. The interviewee stated that there was a recent study at the University of Georgia documenting the push throughout different product areas creating the demand and the influences on the consumer to look for eco-friendly alternatives.

Specifically, the interviewee discussed a line of backpacks where the material used was strongly influenced and driven by environmental decisions. In creating sustainable products there often becomes a higher risk for flaws in the product manufacturing process. The interviewee explained that recycled materials often fail safety tests more often because of the reuse and the repurposing of the material. This is important to take note of because with inconsistent materials, there is greater potential for a loss of time, money, and energy in contrast to products using new materials. For example, cardboard can only be recycled and reused four to six times before it loses its strength and reliability, while, in contrast, plastic can be recycled seven to nine times before it is unusable (Ourauckland, 2016). The interviewee states that their company can save materials and effort typically more with packaging than in the product itself. The interviewee stated, packaging is a good area to limit the amount of “ocean bound plastic” in a product.

The interviewee discussed the challenges of producing an environmentally friendly product where the consumer expects environmentally friendly products to cost the same as the non-environmentally friendly product. This poses a challenge for the company but if the product can make the return on investment the company believes it is worth the effort and are committed to pursuing more eco-friendly projects. The interviewee did state that many eco-friendly products are sold for only a limited amount of time, a year or two, in order to keep the company financially healthy. Experimenting with recyclable materials is costly and can strain the company for long periods of time; however, the demand for eco-friendly products is growing and will reduce this strain over time.

3.3. Interview Two - Lead Industrial Designer

This information was collected from a confidential interview with a lead industrial designer from a home improvement company.

3.3.1. Product Research

There are a multitude of processes involved in the research and development of new products. The interviewee explicitly states, “They are built upon the business’s need, whether it be strategic or tactical, like growing a product category. Depending on the size of the company, the research is usually kicked off by the product management team. They conduct research, investigate the market, and assess potential opportunities.” Generating new products and the type of research required is dependent on the budget and the product. It can vary from market research, simply talking to customers or conducting massive surveys.

Another approach to developing new products is “blue sky innovation”. Blue sky innovation can be described as research without a defined goal coupled with gathering reactions

and responses from the real-world application. This is led by the research and development team but can come from cross-functional teams or customers within the field. The interviewee describes that this is where a problem or technology is identified, and a disruptive product idea is generated. A disruptive product enters the “blue ocean” and is seen as creative, a new market, and/or a new tactic for a product in general. Disruptive products stand out to the consumer and stay out of the “red ocean,” which is the cluttered market.

The interviewee explains that research can vary from market research, interviews, shadowing of the archetype customer, and/or conducting large scale surveys. The variation of research techniques is key to the development of innovative products. Additionally, the types of research are dependent on the budget, the type of product, and the current demand for the product in the market.

3.3.2. Design

The design and marketing department meet to develop a product. Mainly the design department meets with product management, a facet of marketing, which is in a similar vein as product development. The interviewee explains that the product manager is “the hub of the wheel” and the design, engineer, brand, and customer facing marketing (department that develops messaging and advertising) all contribute to the product manager. The interviewee states that typically designers do not interface with the customer facing marketing unless the company is relatively small.

Throughout product development, meetings with the product management and branding teams are essential for the designers. In contrast, it is not as important for the marketing and design team to meet regularly. The product management team helps condense and summarize the marketing goals to the design team and vice versa for the marketing team. The product

management department is key to developing a product's success in the market and feeds the necessary information to the other divisions.

During product development, product discussions occur in order to refine the product and often result in disagreements that must be resolved. Within the two departments, the interviewee states, that the largest area of conflict is "design versus cost". Secondary to that is giving the customers a product that they do not know they wanted, versus giving them exactly what they are demanding. The interviewee explains that both of these concerns are usually easily talked through and resolved. Furthermore, these resolutions are helped along by input from specific focus groups, surveys, and other customer insights.

3.3.3. Marketing

While preparing to market the product, the design team provides inputs from the design process such as renderings, sketching, models, and other mock-ups for the marketing department in order for them to create the story for the end-product. Along with the story, the design team communicates what the essential product features are and other key aspects of the product to call out. The design team identifies opportunities for advertisements and the purpose of the design decisions in the product. This collaboration improves the product's connection to the consumer and market. Generally, this communication results in the future customer understanding the product's purpose, price, and the advertising/promotion strategies being more likely to support selling more the product.

3.3.4. Environmental Influences

The demands of eco-friendly consumers influence the product and market, but the effect depends on the product category, price point, targeted retailer, and the customer. The interviewee

states, “if a company is creating an environmentally friendly product it still must achieve the company’s overarching goal, which is to make a profit”. Within the interviewee’s experience, if there is an opportunity to develop a product that has a great eco-friendly based story, the company will aim to achieve that as long as the margins are there to insure profitability.

The interviewee explains that all companies need to be mindful and cautious with eco-friendly products. There is the balance of sales, long lasting products, and profit. For example, if a product or its parts do not need to be replaced regularly then the company could lose profit on that product as a result of reduced sales of repair parts etc. The interviewee gives an example focused on LED lights. This product needs to be replaced only every five to ten years and are extremely popular in the market for a range of reasons: eco-friendly, the small size, cost effective, etc. Even though they are a “massive hit” due to their long lifespan, the company is able to sell enough units to make a profit. They have balanced out the price of the product, units sold, and profit for the company versus the previous less eco-friendly lights.

3.4. Interview Three - Vice President of Merchandising

This is information was collected from a confidential interview with the vice president of merchandising from a luxury outdoor and indoor furniture firm.

3.4.1. Product Research

The interviewee explains that the main technique for generating new product ideas comes from going to industry market events and finding the common trends. They also have “design labs” that are connected with customer to “hear first-hand” from customers who share what products they believe are missing in the company’s collections.

At this company the interviewee states that the design and marketing team meet after the product manager gives detailed information about trends and design lab notes. In the design lab there are initial meetings with the sale representatives. The senior product manager takes this information and sorts it by brand, category, and highlights anything that repeats itself. If more than one representative is calling out the same point, the company will compare the information to the current market as well as use online resources like Fashion Snoops, a trend forecasting and strategic guidance consultancy company. During this research the design team is creating vision and mood boards. The marketing, sales, and design team will then meets and share all that they have learned, and the product manager shares the results from the design lab with the sales representatives. The interviewee describes how this process is necessary to determine and communicate what the product and future design goals are. Otherwise the design team will be unable to begin the product development process. The product manager then meet with designers about every week to ensure trends and key points are met until the development process is complete.

In summary the research for incorporating new product ideas includes online sources like Fashion Snoops, shopping in the competitive market, traveling to shows and seeing what the new products look like. Designers join the merchandising and marketing teams during this research and/or this research is presented to them at later meetings.

3.4.2. Design

The design and marketing department meet weekly to discuss current products and future manufacturing of developing products. The interviewee says these meetings include reviewing current best sellers, voids in the assortment, price points, and material uses for current and future

product lines as well as deciding which supplier can produce which specific item or material and the desired quantity and quality.

The interviewee shared that there can be disagreements between the design and marketing team, but the product managers make most of the final decisions using the data that has been collected. There are rarely conflicts between the two departments because their overall goals are aligned. If there are major disagreements it is likely an emotional tie to a design versus a fact-based issue.

3.4.3. Marketing

The marketing team meets weekly with the design team to stay up to date with the developing products and to provide their input. The designers share the important features, material choices, and dimensions. The marketing team again is able to build upon the design decisions with their market research. Disagreements can happen but as stated before, the product manager helps find solutions through data and observations.

The marketing team helps set objectives for the design team during the developmental period. It is a fluid, collaborative process where both parties share their observations about trends, competitors, and potential designs. For example, the interviewee says their contract branch could need 36-inch round bistro tables and hammered metal is trending in the market. Then there is a discussion about this combination as a potential design, but it is not a mandated product design at this point.

3.4.4. Environmental Influence

The interviewee says there are no major conflicts with development of products and eco-friendly decisions, but the company is conscious of their material use and waste. Their furniture

is already long lasting, and their consumers generally have the mindset that they will keep the product for multiple years due to its price point and quality. Different collections of the outdoor line are guaranteed to not fade in the sun for three to five years. Due to the durability of the furniture, the products can even last for decades, creating little waste. Culturally, furniture is also a product that is rarely thrown away unless it is severely damaged or soiled. Furniture is passed down among families, donated, or reused in some way but rarely thrown away.

The interviewee states that they are more conscious of the safety and environmental factors of their overseas producers. For example, some aluminum-based furniture pieces come in a grey finish that has a chemical in it that is unhealthy for the factory workers in China. The interviewee states that the furniture company has offered to assist financially in creating the proper ventilation system in the factory in order to improve the health and well-being of the factory workers.

3.5. Summary

These interviews provide a deeper understanding of the business process required to launch a successful product. Each interview revealed key points about product development and the collaboration of design and marketing. Possibly the most valuable interview was with the vice president of commercial design at a computer technology company. The interviewee stressed how they select the features for technology-based products and that design and marketing collaborate very early in their product development process. The design team relays information to the marketing team about the product's features. The design team explains which ones are the most important so the marketing team can create proper advertainments and stories around the product. The information provided in these interviews also build upon the research, design, and marketing methods of the case studies in Chapter Two. The variety of responses

within the interviews further emphasize the need for the design and marketing to work in concert during new product development.

Chapter Four

Development of Approach

4.1 Introduction

The approach will assist in EAD design and marketing. Within this study commercial success is defined as product's sales are profitable and there is a return on investment. Commercial success is vital because it allows the company to work cohesively, continue producing products, and to potentially expand and grow.

Ideally, when designing and marketing an EAD, the company needs to identify the market opportunity, define the EAD objective, develop a proper solution, and then review and analyze the product post-production to ensure market share. Throughout the marketing and design process these are all factors to consider and/or address in the EAD's creation. General design considerations relevant to any product design process are shown in Figure 32 below. EAD design should consider many of the same items as shown. This figure can be used to plan out phases of product development, marketing, and manufacturing. The key at the bottom of the figure identifies which areas are engaged during the various product development phases. Green represents the interactions between the designers and engineers. The topics in red represent where marketing is active while blue identifies the design teams' responsibilities. The most critical part of this chart is represented in purple. During those moments the design and marketing team collaborate together. This can be through sharing market research, developing goals for the EAD, and reviewing ways the EAD can be used and more.

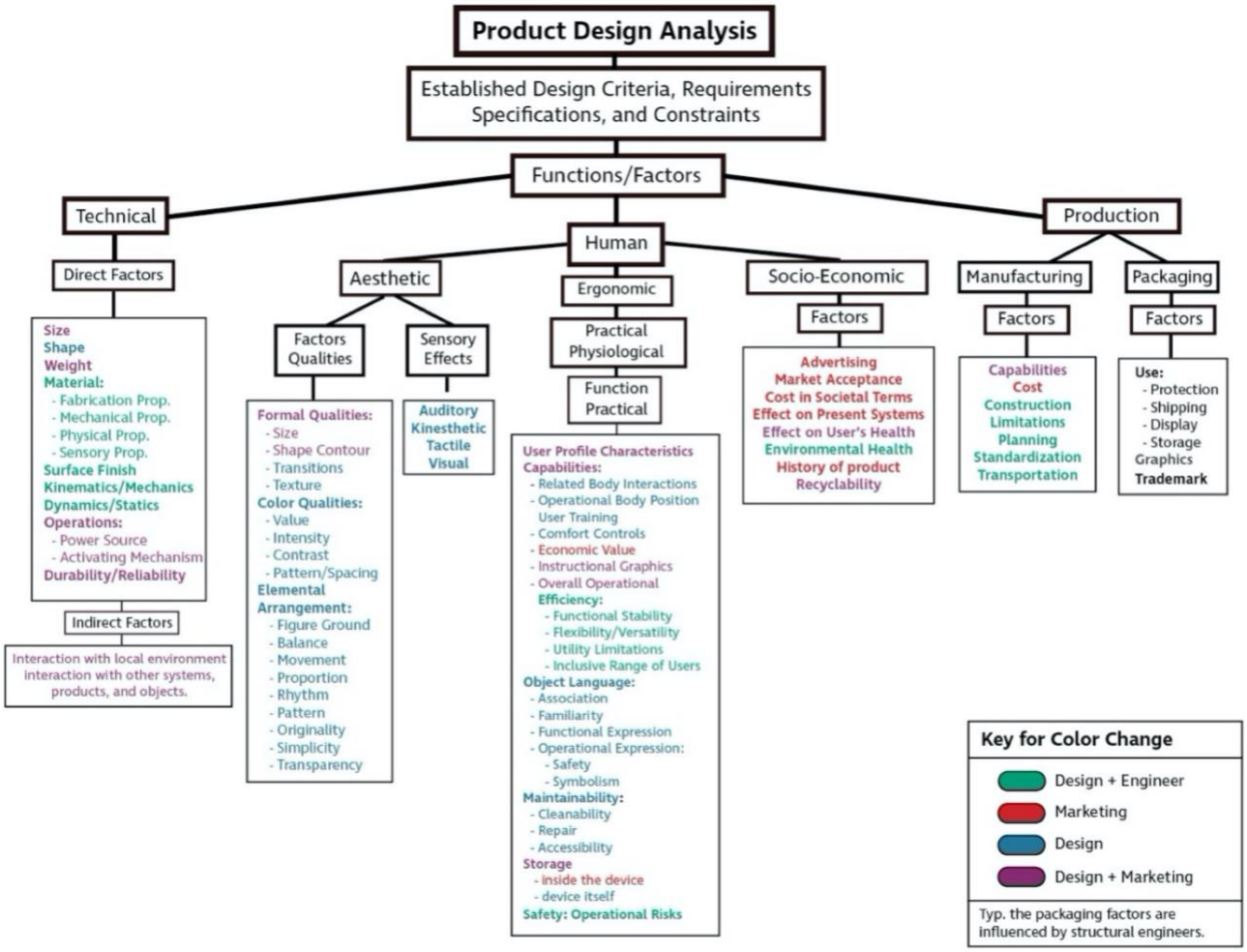


Figure 32. Product Design Analysis and Collaboration (Schaer, 1975)

Referencing the diagram above, a further break down was developed with more detailed elements. The following figures break down the design process of an EAD and the roles each department play. The four sections include; identifying the market opportunity, defining the EAD objective, developing a proper solution, and an analysis of a product's postproduction.

One | Identify the Market Opportunity	
Marketing	1. EAD Product Research 2. Competitor Research 2.1. Online/Forecasting 2.2. Tech Store/Trade Show 3. Consumer Research 3.1. Mass Survey - Overview of needs/wants
Marketing & Design	4. Present info - Summary 4.1. Needs, Wants, Competitors 4.2. Design Musts 4.2.1. Portable vs Stationary 4.2.2. Power Source 4.2.3. Features 4.3. Design Suggestions 4.3.1. Materials, Storage, Capabilities, Audio Quality, Battery Life

Two | Define EAD Objective	
Design	1. Target Group 1.1. Who, When, Where, Why, How 1.2. Design Analyze w/ Diagrams
Marketing & Design	2. EAD Design Plan 2.1. Diagrams

Three | Design Proper EAD	
Design	1. Review Design Criteria from Marketing 1.1. Function & Features 1.2. Stationary vs Portable 2. Early Ideations 2.1. Sketch ,Storyboard, Low Fidelity models, wireframes 2.2. Meeting w/ Design Team
Design & Enginner	2.3. Exploded views - Plan out Internals
Design	2.4. Sequence of Use/Flow Chart 2.5. Environmental Consideration
Design & Marketing	3.Narrowing Concepts 3.1. Review - Function & Features 3.2. Meeting & Feedback
Design	4. Refine Design 4. Semantics, Color, Design Viability, UX, Material, weight, Audio Quality, Lifespan, Form, Storage Capabilities
Design & Marketing	5. In depth User Testing 5.1. Five to Ten users 5.2. Analyze their Experience - Diagrams 5.3. Trade Show/Market input
Design	6. Package Design 6.1. Graphic 6.2. Environmental Considerations
Marketing	7. EAD Message 7.1. Advertisement, Price, Placement

Four | Post Production - 3 to 6 months after release	
Marketing	1. Observations in Technology Changes 2. Analyze Product Reviews 2.1. Technology Websites 2.1. Customer Reviews 2.1.1. Written/Video 3. Review Sales
Marketing & Design	4. Present Summary of Research 4.1. Tech Changes 4.2. EAD Complaints 4.3. Consumer insights
Design	5. Next Generation EAD Development 5.1. Design Decisions 5.1.1. Technology 5.1.2. Customer Complaints

Table 3. The Four Stages of EAD Design

4.2. Identify the Market Opportunity

One | Identify the Market Opportunity	
Marketing	1. EAD Product Research 2. Competitor Research 2.1. Online/Forecasting 2.2. Tech Store/Trade Show 3. Consumer Research 3.1. Mass Survey - Overview of needs/wants
Marketing & Design	4. Present info - Summary 4.1. Needs, Wants, Competitors 4.2. Design Musts 4.2.1. Portable vs Stationary 4.2.2. Power Source 4.2.3. Features 4.3. Design Suggestions 4.3.1. Materials, Storage, Capabilities, Audio Quality, Battery Life

Key for Color Change
Design + Engineer
Marketing
Design
Design + Marketing

Table 4. Identify the Market Opportunity

The first step in designing and marketing an EAD is to identify the market opportunity. All three of the professional interviews identified research as their initial step before any product development begins. There are various types of EADs, and a variety of consumer groups to market and design towards. For example, it could be a portable EAD and a consumer group who is willing to experiment with new technology. In order to maximize the products chances of success the company needs to be aware of the existing EAD's research emerging technology, and the target consumer groups in order to capitalize on the area of opportunity.

In order to learn about existing EADs the marketing team will need to research online sources, trend forecasting sources, visit the technology centered stores, attend trade shows, communicate with field experts, and interview product users. Gathering all this information is key when understanding the consumer's expectations and determining market and advertisement strategies. This research should be conducted over a few months or until the marketing team

believes they truly understand the current EAD market (Hagglund, 2020). The EAD will not be well received if it is outdated or too advanced for the consumer. Raymond Loewy (1951) states, “If design seems too radical to the consumer, he resists it whether the design is a masterpiece or not” (p.157). The marketing team can present the results of their research and analysis to the design team and identifies areas of opportunity and possible deliverables.

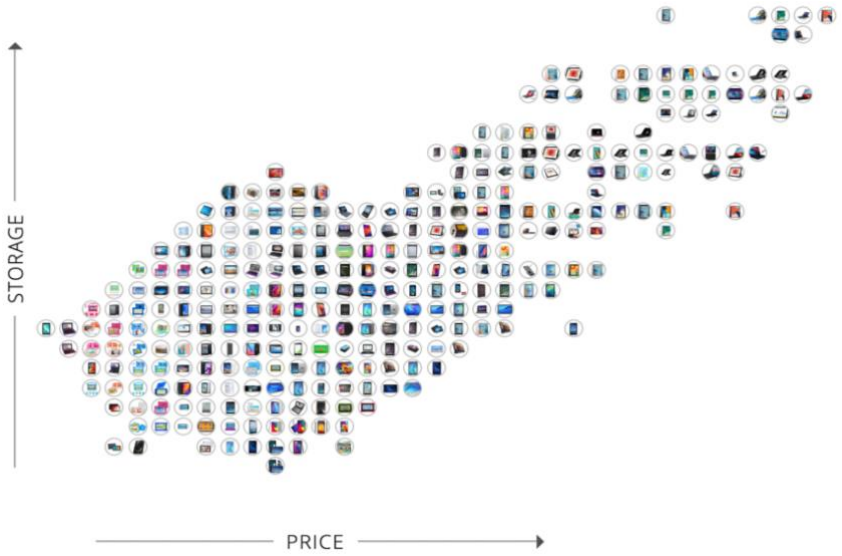


Figure 34. Laptop Product Analysis Chart (ProductChart.com, 2020)

Above is a product analysis chart comparing and contrasting price and storage for laptops. This visual technique can be applied to EADs when trying to learn about the current market. For example, the marketing team could have noticed popularity in a feature such a voice recognition technology and suggest the EAD include that feature. When the marketing team is able to observe patterns of success in current EADs it increases the likelihood of the EADs, commercial success in the end. Additionally, it reduces the chance of massive design changes mid-development because the design team has frequent meetings with the marketing team or product manager. Without conversations and regular presentations, the EAD design could progress in the wrong direction.

The second step in identifying the market is by analyzing consumers and finding the group within the EAD consumer population that the company wants to target as their market. The marketing team should conduct a focused survey consisting of 10 or so questions that identify the features and design attributes that the target group desires in an EAD. Survey design must be generalized, relatively short, and designed to answer specific questions such as size and weight, what features are most important – storage capacity, battery life, etc... The mass survey should minimize if not outright prohibit fill-in-the-blank style questions as it will be challenging to identify any patterns or key points quickly if sorting through a mass of written information for each answer. It is important to gather a minimum of a hundred responses from the specific target market to understand people's thoughts and routines with EADS (Bullen, 2014). This research should reveal areas of interest for the EAD such as features, size, weight, and some technology features.

The marketing team should also interview another sample of the target group in person and with much more detailed questions after assessing the data from the first survey. In-person surveys or interviews tend to be more revealing about how someone actually feels about a product, their habits, and may even offer suggestions for the developing product (Babich, 2018). This research should reveal the specific needs and wants of the target group, features, material types, form, size, weight, storage capacity, battery life, audio quality, and other technologies the company can investigate including in their new EAD product design. This research will narrow down and add clarity to the target group identity. The marketing team collaborates and communicates this information to the design team.

In Chapter Three, the detailed interviews with professionals describe their user research techniques. The Vice President of Commercial Design for a technology-based company stated

that during their research phase they determine what the user wants and then the company decides on the features to deliver. Product development within technology sectors is especially complex due to the rapid advances and changes within that sector. Product research is multi-pronged and includes user research, ethnographies, concept testing, company reactions, and adjustments along the way. It must be based on real data and real consumers.

A specific example of identifying the market can be seen through the SanDisk Clip Jam case study described in Chapter Two. When developing a new MP3 player in the age of smartphones, SanDisk found an opening in the market with the production of the Clip Jam. This was particularly important as current smartphone technology has generally replaced the need of a MP3 players in many cases. SanDisk was able to discover the area of opportunity. There is a consumer group who appreciate simplified technology. This is evident through online reviews of the Clip Jam where consumers overall shared that the "No-frills MP3 player" replaces their smart phone (Blanco, 2016). Earlier in this study there was an interview with a Clip Jam owner who described the main reason for his Clip Jam purchase was due to "the simplicity, low price, compact form, and compatibility with his audio files." The interviewee also does not own a smart phone and expressed his enjoyment from using less technology in his day to day to life. It is a bit of a contradiction, but due to lower perceived value of the product, it is even more valuable to consumers. In contrast, the Zune HD case study in Chapter Two reviewed the lack of success the product had within the EAD market. Microsoft did not adequately identify their market during the design process and was not able to create a diverse enough product to penetrate existing markets.

Identifying the market opportunity sets the groundwork for the EAD's development and objectives. All three professional interviewees from widely different industries expressed the

importance of market research and why it is their first step in any product development effort. Once the research is mature and the marketing team is able to make conclusions based on the data, they present their findings, and possible target group to the design team. This is where the vision and objectives of the EAD start to become concrete and help to ensure a successful product design that has the best chance for commercial success.

4.2.1. Summary

This section highlights when the marketing team interacts with the design team along with their main responsibilities while identifying the market opportunity for EADs. The marketing department identifies the market opportunity through surveys and research then communicates the significant findings to the design team. The marketing team explains to the designers what the "need" is of the EAD, what the competitors are doing, and other suggestions about the EAD itself.

4.3. Define the Electronic Audio Device's Objective

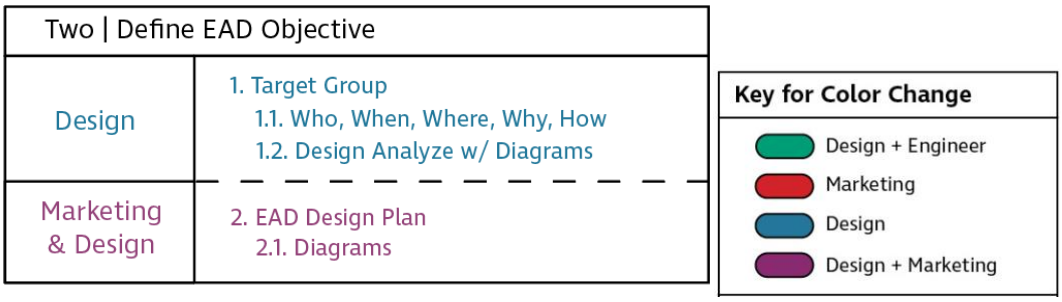


Table 5. Define the EAD Objective

The second phase of developing a commercially successful EAD is defining the objective of the EAD. This includes outlining the product's deliverables and the company's goal with the

product. The case studies and interviews emphasized how vital a clear direction for designing, marketing, and manufacturing an EAD is. Additionally, given today's emphasis on green design, environmentally friendly design decisions are also key to producing a successful EAD. Understanding the objectives will enable the employees to clearly analyze the research and thus be able to meet the objectives of the EAD with a more authentic and fine-tuned design. The marketing team communicates to the design team who their target group is from the data they've collected previously.

While defining the developing EADs' objectives, there needs to be an understanding of "Why" and "How" the EAD is being created. Creating a Heuristic Plan of Action Chart encourages the designer to think about "Who, What, When, Where, and How". The designer will learn, discover, and test problems by experimenting and evaluating possible solutions.

	Who	What	When	Where	How
Need for an EAD					
Changing audio selection					
Charging/Powering EAD					
Audio Output					

Table 6. Heuristic Plan of Action Chart Blank

The column on the left can be supplemented or changed out with other questions that the designer needs to answer or research.

The marketing team needs to select a target group from their research that they can capitalize on and/or is underserved. Additionally, they will have determined where and when the device will likely be used. The marketing team should use their guidelines and research and apply it to the Hierarchical Tree Structure chart and discover the areas and scenarios the EAD could be used. The purpose of this chart is to illustrate the connections within and around the EAD. For example, it could include the parts, components, sub-system, system, and environment. This mapping of environments and sub environments will help decide on the possible areas of use for the EAD.

System Concept	**The Evalutalon of the Use of an EAD** Hierarchical Tree Diagram
Environment	
System	
Sub System	
Components	
Parts	

Environment: The outlining area of the system.
System: The main element to be evaluated.
Sub System: The second main element of the system.
Components: The main elements of the sub-system. This can be a system.
Parts: Features of the system.

Table 7. Hierarchical Tree Diagram Blank

The marketing team shares this information with the design team, and they begin to decide exactly what type of EAD their new product will be, i.e. will it be portable or stationary, etc.. Additionally, the CEO/executive team must decide how much time and money the company is willing to invest in developing this new product. This decision is directly based on the research

presented by the marketing team and the forecast of how valuable the EAD could be to the company.

The EAD's objectives are mainly influenced by the target group's needs, expectations, and desires but they are finalized through a collaborative decision of the marketing team, design team, and the product manager. Using a SWOT analysis chart both the design and marketing team can collaborate and outline what they think the strengths, weaknesses, opportunities, and threats are for the developing product. Thinking through these elements will assist in creating a more well-rounded EAD, avoid potential mistakes in the EADs development, and overall improve relations between departments.

Strengths What do you do well? What unique resources can you draw on? What do others see as your strengths?	**Weaknesses** What could you improve? Where do you have fewer resources than others? What are others likely to see as weaknesses?
Opportunities What opportunities are open to you? What trends could you take advantage of? How can you turn your strengths into opportunities?	**Threats** What threats could harm you? What is your competition doing? What threats do your weaknesses expose to you?

Table 8. SWOT Template

Once the objectives are finalized, a firm schedule can be developed that incorporates cost, time, and resources required to complete product design. Spending time and resources on planning sets the stage for a successful product (Babich, 2018). The marketing and design team with the product manager define the design criteria, requirements, specifications, development timelines and budgets, and any constraints to those elements. This is achieved through referencing all of the research to include the target group's needs and desires as well as any manufacturing constraints or limits. This approach also suggests planning each phase of the product's development and tracking it with a Gantt chart. This tool helps keep the product's development on schedule, expectations clear, and status visible to the entire team. For example, the Gantt chart could include phases such as the product research, user surveys, initial EAD ideation, evaluate manufacturing methods, and so forth.

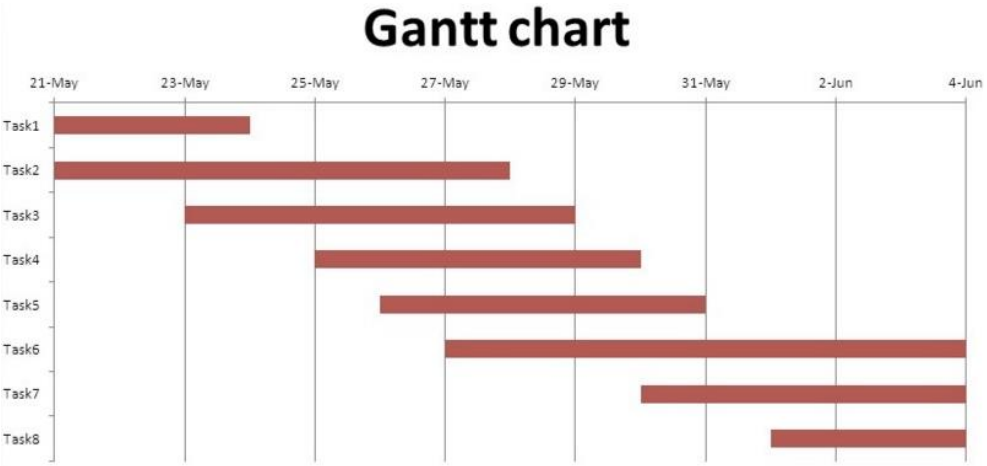


Figure 35. Gantt Chart (Appfluence, 2016).

The project manager will hold regular meetings with everyone working on the EAD to ensure key milestones of the product's development are met and the schedule maintained. The Vice President of Merchandising interviewed shared how defining the objective of the product is

an absolute necessity and that without it the design team will be unable to begin the product development process due to lack of guidance and direction.

4.3.1. Summary

This section highlights when the design team interacts with the marketing team along with their main responsibilities while considering what the main objectives of the developing EAD will be. The design team narrows in on a target group and analyses their habits and lifestyles. With this information the design team meets with the marketing department. The design plan is then debriefed. The marketing team will help solidify the design objectives and overall EAD direction.

4.4. Design a Proper Solution

Three | Design Proper EAD	
Design	1. Review Design Criteria from Marketing 1.1. Function & Features 1.2. Stationary vs Portable 2. Early Ideations 2.1. Sketch ,Storyboard, Low Fidelity models, wireframes 2.2. Meeting w/ Design Team
Design & Enginner	2.3. Exploded views - Plan out Internals
Design	2.4. Sequence of Use/Flow Chart 2.5. Environmental Consideration
Design & Marketing	3.Narrowing Concepts 3.1. Review - Function & Features 3.2. Meeting & Feedback
Design	4. Refine Design 4. Semantics, Color, Design Viability, UX, Material, weight, Audio Quality, Lifespan, Form, Storage Capabilities
Design & Marketing	5. In depth User Testing 5.1. Five to Ten users 5.2. Analyze their Experience - Diagrams 5.3. Trade Show/Market input
Design	6. Package Design 6.1. Graphic 6.2. Environmental Considerations
Marketing	7. EAD Message 7.1. Advertisement, Price, Placement

Key for Color Change
Design + Engineer
Marketing
Design
Design + Marketing

Table 9. Design a Proper EAD

The third phase for an EAD to be commercially successful is designing a proper solution around the design criteria and requirements the marketing team developed. This design is derived from the target group's needs, wants, and technology expectations as determined from the research. According to Walter Schaer (1979), design interactions, the marketing and design team should consider the human function, technical function, and production function. A well-engineered EAD may be rejected if it does not fulfill the human need. The human needs include that the perceived value of the EAD is "fair", the EAD fits into society and culture, and the product is practical and efficient.

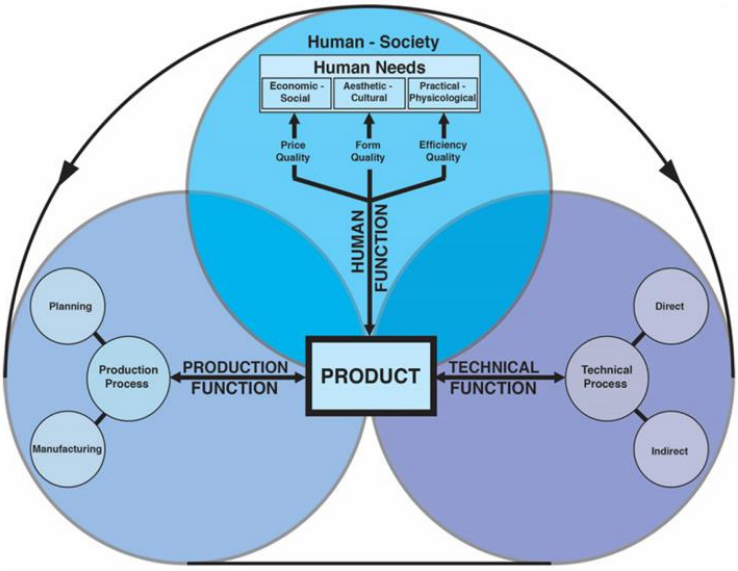


Figure 36. Design Interaction (Schaer, 1979)

Once the purpose and target audience of the EAD has been determined, the design team will begin with hypothesis of all possible solutions.

The concept, form follows function, is generally accepted by practitioners in the design field. In 1896 the American Architect, Louis Sullivan, coined this phrase in his book, The Tall Office Building Artistically Considered,

> It is the pervading law of all things organic and inorganic, of all things physical and metaphysical, of all things human and all things superhuman, of all true manifestations of the head, of the heart, of the soul, that the life is recognizable in its expression, that form ever follows function. This is the law. (Sullivan, 1896)

Furthermore, many other contemporary designers support the concept of "form follows function", such as Frank Lloyd Wright, Adolf Loos, Walter Gropius, Mies Van Der Rohe, and Philip Johnson. Like any theory or concept, it can be disputed, but it is widely trusted and used as a design technique for a product's development and success (Bradley, 2019).

While the general guidelines for designing any product can be referenced in Chapter One within Dieter Rams 10 Principles of Design, there is no dogmatic approach for all design. There are, however, some specific design principles to aim for in the design of EADs. The product designer must understand their target group's needs and desires. Additionally, a well-designed EAD will bring the user joy, which should be observed in user testing. Norman (2002) stated, "Attractive products work better" (p.41). Mugge, Schifferstein, and Schoormans (2008) found that user satisfaction was also influenced by a products utility and product appearance. If there are still questions or problems in solving design issues, the team should return to their research and collect more data on the specific design, consumer group, or technological unknowns. Through research, user testing, consulting others, and understanding the design objectives refining the small details will be worked out (Bachich, 2018).

The marketing team should communicate to the designers whether the EAD will be portable or stationary through the target group research. The placement of an EAD can be on

counter space such as a personal speaker system or be handheld and portable like the Clip Jam or Zune. A portable EAD is wireless, weighs less than a pound, compact, and potentially wearable. A stationary EAD needs a semi-constant source of energy, as in it needs to be plugged into a wall power source to function. A stationary EAD also should be larger than five inches in either height, depth, or width to increase its stability and enhance its visibility. This chart below reviews in more detail what aspects make an EAD stationary or portable. This is not a dogmatic guideline but can assist the designer during the product development.

Guidelines for designing a portable or stationary EAD.
The EAD needs to be five or more of these a category.

	Portable	Stationary
Size	No larger than 7 inches in more than two these categories: height, width, or depth.	Over 2ft in height, width, and depth.
Energy Source	Battery/DC powered.	Constant energy source, AC powered (primarily).
Material	A durable material. Likely to be dropped and be in many outdoor/traveling scenarios.	Defined by the design criteria. Durable Material is typically not as vital.
Audio Output	Audible speakers and/or compatible with headphones.	Audible, quality speaker. Could connect to headphones
Technology	Bluetooth, touchscreen, few physical buttons, emphasis UX/UI. Could include the internet	Bluetooth, voice recognition, visual affordance for the buttons. Possible a touchscreen and internet connection.
Storage Capabilities	Large storage capabilities. Comfortable to have 8gb to 32gb. Try to find it built in.	Cloud-like storage capabilities, or media on accessories like a tape, CD, record, or SD card.
Form	Designed around handheld ergonomics. Ability to function in different scenarios- pockets/bags. Limited number of physical buttons.	Defined by design criteria. Some type of grip on the bottom. Interface on the front or top for a clear use.
Color/Finish	Neutral or vibrant colors. Matte to avoid showing fingerprints or scratches	Neutral color or influence by the predicted locations of use.
Areas of use	Adaptable, portable, movable. Different environments, work, car, house, gym, etc.	Interacts with one to three environments: Home/work/offices. Two to three sub environment such as different rooms in a building or a porch. Could be mounted or installed onto a surface.

Table 10. Portable vs Stationary

Through the marketing research and identifying the consumer group, it will be evident whether or not the EAD should be stationary, in a household-like setting, or if it should be an on-the-go audio device. This decision will be the driving force behind the upcoming design decisions such as the weight, color, battery size, and so on. It is vital for the company to make this decision in the beginning of the design, because it will influence the design decisions during development.

Once the objectives/core values of the EAD have been established, the design ideation of the EAD begins. The designers start creating a variety of sketches and conducting brainstorming sessions. Sharing ideas allows the design team to find the strongest facets in each idea and remove the concepts that are not feasible. During the early phases of ideation, the designers may realize they need more information on a specific aspect of the EAD or the consumer group. Since the target consumer group has been identified from the general survey, the marketing or design team can develop the next survey. This survey may target fewer people, but those should be "experts" or very familiar with the subjects that the designers or marketing team are trying to learn about. The company should have historical information on people who are available to take the survey, customer lists or ways to facilitate getting the survey to others. Once the new information is collected and analyzed, product development and ideation continue. The designers share their concepts with each other using various methods such as: sketching, storyboarding, low fidelity digital/physical models, wireframes, collaborations, and other methods they see fit (Babich, 2018).

The designer needs to understand which components of the EAD are necessary. This will improve the designer's ability to change different aspects of the EAD. Creating an exploded view or an interaction net (chart) will strengthen the designer's comprehension of the EAD and its internal and outward mechanics. Both of these techniques are not essential for the design process but can assist the designer in the EAD production, function, and communication to other departments.

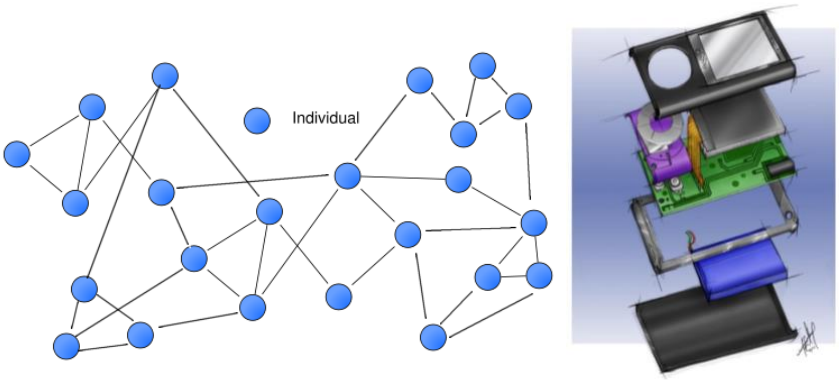


Figure 37. Left - Interaction Net (Ramsahai, 2017)
Figure 38. Right - Exploded View (Critterunknown, 2016)

Another visual chart that can be created is mind mapping or sequence of use chart. It ultimately can improve the functionality of the EAD and enhance problem solving between the designers and marketing team.

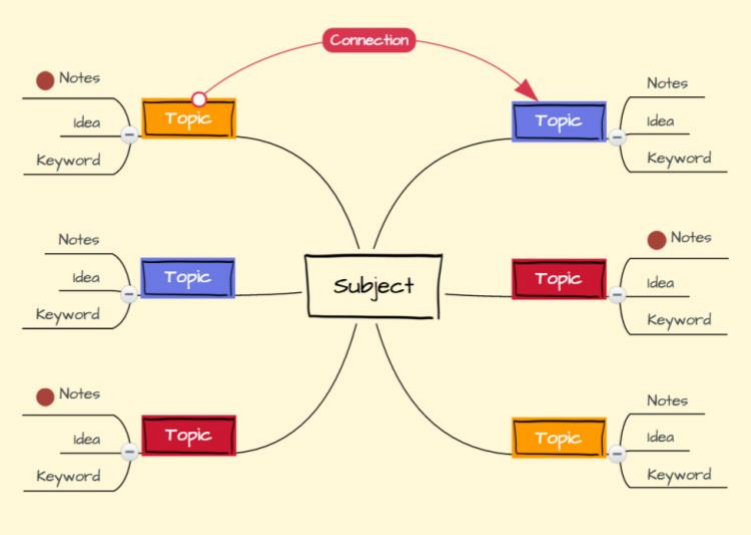


Figure 39. Mind Mapping (Collins, 2019)

The sequence of use flow charts will assist the designer integrate and decide what aspects to include in the EAD from technology features to switches (Schaer, 1979).

At this stage the design team should have two to five concepts selected. They are the ones that appear to be the most aesthetically appealing, user friendly, and achieve the requirements for

the researched target group. The design team will then create digital and/or physical models to present to the project manager. The project manager and a member(s) of the marketing team will assist the design team in selecting which design/concept appears to be the most plausible with their goals and constraints. This will happen through meetings, demonstrations of the EAD, and possibly through low fidelity prototype testing with company employees. Once the concept is finalized, more of the hard points of the EAD can be determined such as the form, audio quality, product lifespan, color, materials, weight based on internals and material, and graphics. Designers will also begin to be able to make green design decisions involving material, packaging, graphics, and the EAD assembly and disassembly methods as the design is more mature.

The expected lifespan determined by the marketing team influences the design of the product. If the product is expected to last more than a few years, the primary material will most likely be a type of metal or durable plastic. The internal components will be stable, secure, and use high quality internal parts and technology. The audio output will be higher quality due to its expected lifespan. The color of the product will likely be more neutral to fit within the environments it may encounter over a longer lifespan. If the user keeps a keeps an EAD for years it is because ultimately it works well and fits their lifestyle. Whether the EAD is expected to have a lifespan of one year or a decade, the durability, recyclability, compatibility, and EAD disassembly should be kept in mind during the development, especially when selecting materials, internal technology components, assemblies, and selecting the raw material. The most ethically sourced options, environmentally and for the workers, should be what the company aims to achieve.

Overall, the UX/UI, semantics, and features should have visual affordance for any product design. For example, if iconography is used, it should use universal symbols. The iconography for audio products is fairly mature and any new product should really follow those standards, i.e. play, stop, reverse, increase volume, decrease volume, repeat, etc.

Figure 40. Audio & Video Solid Icons (Avery, 2019)

Technology based products can often be over designed and overwhelm the user but keeping the functions visually universal can improve the user experience. This is mainly due to the fact that technology is rapidly changing, and the users often feel like they are having to play "catch up". Norman (2014) described this phenomenon as "Learned Helplessness".

With clear user visibility (purpose of product) the product is more likely to be used correctly. There should to be a level of visual identification with the EAD. For example, the EAD needs to look like it is associated with audio. This could simply be done with speaker holes or a location for a headphone jack. When using the product, there must be something that communicates to the user that it is working correctly. Norman mentions sounds for visibility, reaffirming sounds, clicks, snaps, and so forth. Additionally, there could be sounds when the EAD is not functioning

correctly. For example, there could be a low buzz, chirps or hiccup like sounds when there is an error or audio is lagging instead of complete silence. Silence could mean a number of things such as poor Wi-Fi, the product has run out of energy, or the audio file is corrupt. A combination of sounds and visuals will communicate the clearest message to the user and enhance their user experience. The more of the five senses that are incorporated in the EAD, the more it will enhance its communications to the user. Overall, if done well, the use of all senses will alleviate the learned helplessness phenomenon and prevent users from blaming themselves. For example, using the appropriate visual signal/symbol, auditory sound or haptic feedback to warn the user if battery is low, a file is corrupt, or dimming the screen to avoid unintended tapping can be a great help to the user (Norman, 2013).

The prototype then needs to be user tested by the target group the company is designing for. The observations should be recorded by a member of the design team or the project manager. It will be a more refined design of the EAD, but it will be limited in functionality due to the likelihood of changes in the EAD after this testing. The prototype could even include multiple models to communicate the UX of the EAD and features. The observer needs to video record the user's experience and write down moments where they had success, blunders, and even enjoyment with the prototype. Overall the testing should put the user in a combination of scenarios and tasks that use all of the features and capabilities of the EAD. The results and data gained from the user tests should be analyzed by the design team and project manager. There should be five to ten users testing the prototype EAD. Some of the test users should be "outsiders" from the target group to gather more information that could be insightful. These scenarios and questions should be influenced by flow charts and sequence of use charts specifically for the developing EAD.

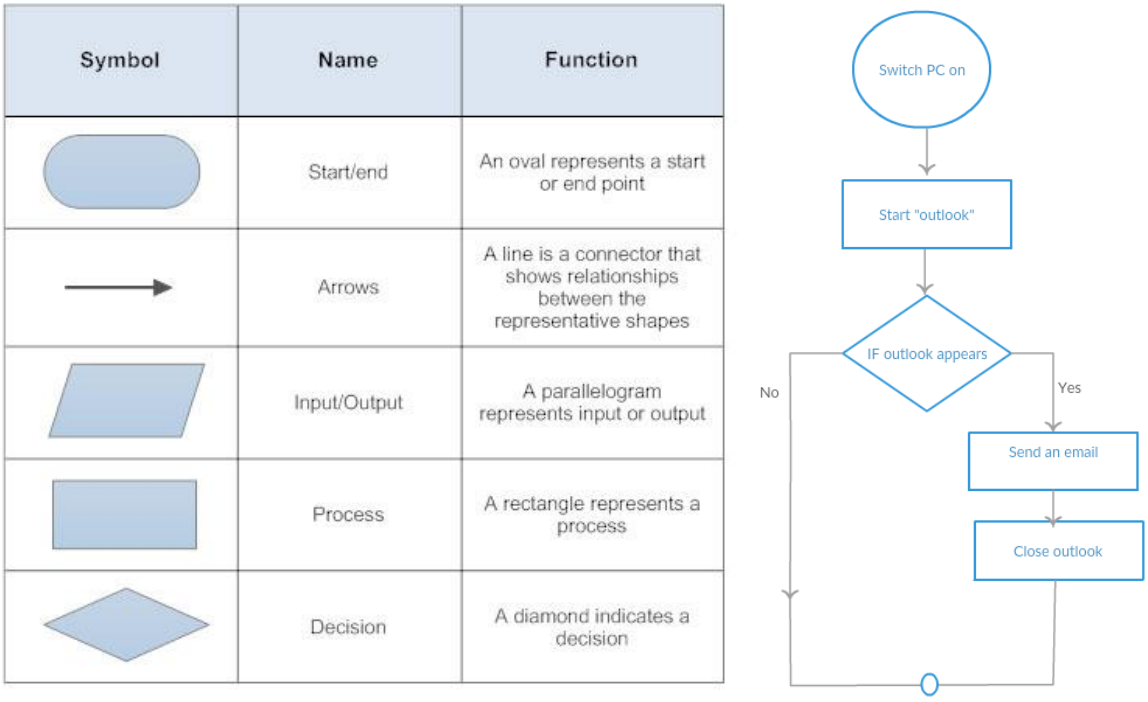


Figure 40. Easiest Way to Solve Statement and Branch Coverage Problems (Hegde, 2016)

The design team will use these techniques during the development phase and can \ identify areas of importance in the EAD sequence of use (Schaer, 1979). The user tests will include retrieving/downloading the audio, activating and listening to the audio, adjusting settings, using the features (Bluetooth, voice commands, touch screen, etc.), adjusting the volume, turning the EAD on/off, skipping an audio clip, reading the user manual, and opening the package. There can be multiple prototypes used to demonstrate different actions. They can range from a cardboard mockup to a touch screen device that has the commands downloaded. The prototypes should aim to communicate as many of the features and functions as possible. The questions that are asked should be based around the deliverables and goals of the EAD. The most important aspects to be observed are: How easily can the user determine the function of the device, how easily can the user perform the functions, is the EAD enjoyable, and does the user understand

what actions are possible with the EAD (Norman, 2013). A frequency chart could be included to create visuals to see how many times the interviewee used different buttons, settings, or features. It could show what the user found enjoyable, frustrating, or even forgotten as they experimented with the device. The tests and questions will vary slightly from EAD to EAD but should reveal faults in the design or errors that the testers could make as a result of unexpected approaches through the EAD's interface (Tromm, 2018).

NUMERCIAL FREQUENCY CHART						
	OBJECTS TO BE EVALUATED					
TIME	Cell Phone	Tea	X-Acto	Glue Gun	Planner	Pencil
8 to 9	3	5	0	0	1	3
9 to 10	2	3	1	1	2	2
10 to 11	1	1	2	4	0	5
11 to 12	4	0	0	0	4	4
TOTAL	10	9	3	5	7	14

Table 11. Numerical Frequency Chart

This frequency of use chart is an example based around a student and how many times they used different tools over a class period. In this study the context should include different aspects of the EAD such as the play button, back button, on/off, other specific features, and so forth. This will assist in improving the layout of the controls of the device and the overall design. The Right-Wrong chart is a tool that identifies areas of a product that needs improving. This is a technique the designer could use to visualize their responses from the interview.

Parameter	Right	Wrong	Recommendation
Scenario Example (play audio)	The correct way to approach the scenario	The incorrect way to approach the scenario	Ways to avoid the wrong path
Scenario Example	Ex.	Ex.	Ex.
Scenario Example	Ex.	Ex.	Ex.
Scenario Example	Ex.	Ex.	Ex.
Scenario Example	Ex.	Ex.	Ex.

Table 12. Right-Wrong Chart

As the feedback is collected a Right-Wrong chart could be used to identify areas of the EAD that could be improved.

The marketing team should participate in a trade show with the prototype design if possible. Being part of the trade show exhibit will enable the team to receive feedback from other technology-based companies and other industry experts that attend. In the previous interview, the Vice President of commercial design for a technology-based company shared that their company attends multiple trade shows to receive vital feedback on the tech-based product they have developed. The company joins in these shows to receive input on their refined, mostly functional prototype from other technology companies and clients. It allows the company to receive insights but also see what their competitors are creating. A few small changes in the product or even major changes, if necessary, can improve the potential for success of the EAD. The Vice President of commercial design also stated that they typically release their product a year or two after attending trade shows. This communication and feedback allow more room for refinement of the EAD design before it is finalized and production begins.

The design of the EAD and its packaging as well as its manufacturing should be as "green" as possible. The professional interviews emphasized the marketability of environmentally friendly products. Eco-friendly designs can be very costly short term for a

company but are also important as the ethically correct thing to do as well as being highly desirable and marketable for the target consumer group and potentially beneficial in the long run. Green design and manufacturing costs must still be realistic and allow the company to make a profit. As the EAD gains market share and is successful, more eco-friendly changes could be made as production continues and could be incorporated into marketing tactics. The materials used in the EAD should be thoughtfully selected for its purpose with careful consideration to their ecological factors both in obtaining the raw materials and the ability to reuse or disassemble them at the end of the product's life. Material engineers should be able to refine and minimize the material used in the structure and components of the design to ensure the least amount of material is used while limiting the waste produced in the manufacturing process.

The design team should be an integral part of the packaging design. Packaging is a major area that can be refined in order to use eco-friendly products constructed of renewable or recyclable material due to the short-expected lifespan of the packaging. This study suggests making the packaging as compact as possible and, if possible, to use cardboard, paper, cardboard pulp, or similar biodegradable materials. Plastic use should be limited to the absolute minimum. Even with a green design focus, the packaging must have reliable structural integrity to protect the product through shipping, on the store shelf, and during transport home with the consumer. Packaging should undergo the same testing rigor as the product and as a minimum be capable of surviving a typical product drop test of withstanding typical logistic expectations (Burkhart, 2018). The ability to minimize packaging reduces waste in production and shipping expenses of the product and the raw material.

Once the EAD's lifespan ends, it can become electronic-waste and potentially release toxins into the landfill surrounding environment. Optimally, the design team will coordinate

within the company to have a system where the user can return the product to the company or a designated recycling center where the metal, plastic and electronic waste can be recycled or disposed of responsibly. In the chart, below the product life cycle is shown and starts with the extraction of raw material, to possible recycling, and ending with landfills. There is a variety of potential product life cycle options ranging from the product being reused as the most ecologically friendly to the incinerator or landfill as the worst-case scenario for disposal at the end of the product's lifecycle.

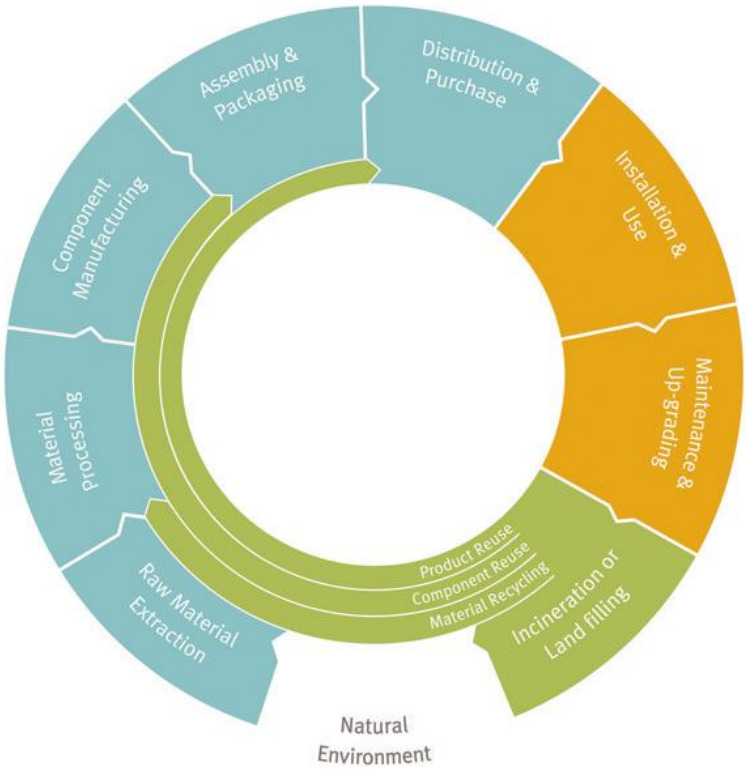


Figure 42. Product Lifecycle (Okala, 2014)

Once the EAD design is complete, the marketing team steps back in. In the interview with the Vice president of Commercial Design, he expressed that the mission of the marketing team is to sell what has been designed and communicate the company's brand, story, and goals. The marketing team's involvement throughout the process and the design phase ensures that they

are not starting from scratch and have created numerous preliminary ideas on how to market the new product. Generally, the product manager reiterates to the marketing team the features, advantages, and benefits for the company's target consumers. The TV and radio commercials, print ads, and packaging essentially "speak for" the product and serve to personify the benefits of the product to the target consumer group. The marketing and design team work together and focus on the different features and benefits of the design in order to ensure a successful marketing campaign. During the last 20% or so of the design process, weekly meetings with the design, marketing, and project manager should be conducted to review the design features and marketing and advertising strategies.

4.4.1. Summary

This section covers when the marketing team interacts with the design team collaborate along with their main responsibilities when designing and developing an EAD. The designers meet with the marketing team and managers early with concepts and get their feedback. The designers stay current with market research and create a low fidelity model and test it. The marketing team will be observing users' reactions as well and assist the designers with their feedback. At the end of the design process and once the EAD design has been approved, the designers, graphic designers, and possibly structural engineers will finalize the packaging.

4.5. Post-Production

Four | Post Production - 3 to 6 months after release	
Marketing	1. Observations in Technology Changes 2. Analyze Product Reviews 2.1. Technology Websites 2.1. Customer Reviews 2.1.1. Written/Video 3. Review Sales
Marketing & Design	4. Present Summary of Research 4.1. Tech Changes 4.2. EAD Complaints 4.3. Consumer insights
Design	5. Next Generation EAD Development 5.1. Design Decisions 5.1.1. Technology 5.1.2. Customer Complaints

Key for Color Change
Design + Engineer
Marketing
Design
Design + Marketing
Typ. the packaging factors are influenced by structural engineers.

Table 13. Post-Production

The final step in ensuring commercial success is post-production feedback and revisions. EADs can be designed well, but with the passing of time and new technology advances the market environment can change. Additionally, other improvements for the EAD itself can become apparent once a product has been mass-produced. The company should also reach out to users who have purchased the EAD asking for feedback through emails and letters. According to Aelieve, reviews and critiques of tech products will also naturally appear online with time on websites such as CNET, TomsHardware, and TheVerge, and on social media. YouTube additionally contains thousands of videos reviewing EAD products. These sites may not always be current, but it is the responsibility of the company to stay attuned to these sources as they come and go. Users are constantly sharing their product experiences through a multitude of outlets. This feedback allows for accurate updates on the EAD, ranging from UX to the product's form to the durability of the product

If the product is commercially successful, then new “generations” or follow-on versions of the EAD should be considered. Once a successful product has been in place, this potentially creates brand loyalty (Muhammad, 2017). This is seen with the iPod vs Zune HD. The first Zune was released 5 years after the iPod and as described in the case study, Microsoft could not compete with Apple’s customer loyalty.

In refence to the case study in Chapter Two, the Muji wall hanging CD player, released in 1999, has been sold for over three decades. Muji has made a few post-production changes and has updated the product with new technology to improve the user experience. There was a FM radio added to the CD player, a remote control, and a backlit Liquid Crystal Display (LCD). Additionally, the packaging and production was simplified to match their corporate eco-friendly approach and the mood of the market with the company deciding in 2011 to use 20% less material within the product itself and packaging.

4.5.1. Summary

This section highlights when the marketing team interacts with the design team along with their main responsibilities after the production and sales of an EAD. Once the EAD has been released consumer feedback and reviews should be collected almost immediately, but not deeply analyzed until 3 to 6 months have passed after the EAD release. Technology changes take about this much time to manifest and it allows enough time to pass to gather a range of reactions to the device and longer-term sales data. The marketing team will analyze the customer feedback and sales. Then will communicate to the design team what they believe to be successful and unsuccessful with the EAD and why. Then the design team will make changes accordingly for the next generation of that EAD or a new EAD altogether.

4.6. Conclusion

The design and marketing teams must work in harmony and meet regularly at specific times and phases to develop a successful EAD. The process includes identifying the market opportunity, defining the EAD objective and goals, designing an EAD, and then reviewing and analyzing the product post-production. The design and marketing team work together to conduct technology research, EAD market research, environmental research, and target group research. The design team focuses on the design development and decisions while the marketing team focuses on the design requirements such as branding, placement, pricing, advertising, and user reviews of the EAD post-production. Throughout the marketing and design process these are the factors that must be addressed to create a successful EAD.

Chapter Five

Application of Approach

5.1. Limitation

The application of this approach is necessarily limited in regard to resources, research, and communication and feedback with professionals. However, the fundamental concepts hold true. When a designer uses this approach, they do so with direction from the company. With this direction, one can more easily align the design with the aim of the EAD. Such information will likely stem from collaboration with the departments of marketing, engineering, and management. Other resources not available to a theoretical application include tangible resources such as materials, multitude of sketch and physical prototypes, manufacturing tests, as well as intangibles like attending trade shows, current customer surveys, and feedback from co-workers. Despite the absence of such input, this theoretical application will be as accurate as possible through an EAD design and marketing demonstration.

5.2. Identify the market opportunity - Introduction

The approach for designing and marketing an EAD will be applied and demonstrated through this chapter. There will be focus on identifying the market opportunity, research on the target audience, and defining the goals and purpose of the EAD. An example EAD prototype will be produced and a simulated post-production review will be completed based on the observations and reviews from a user test subject.

5.2.1. Identify the market opportunity – Demonstration

The first step to development an EAD is to conduct market research. Market research assists in identifying a target consumer group, market opportunities, and creating the objectives

of the EAD. In order to maximize the product's chance of success, research on existing EADs, emerging technologies, and the target consumer groups must be conducted in depth in order to identify and capitalize on the market gap within the existing EADs in the marketplace. The majority of the research is done by the marketing team, analyzed, and then presented to the design team. As the market opportunity becomes more defined, the design team will participate in pockets of the research efforts as well in order to fine-tune design concepts in concert with the data.

5.2.2. Identify the Market Opportunity

Researching technological companies such as Apple, Microsoft, Samsung, Intel, IBM, Google, Sony, and Dolbey is critical in EAD product design. This is due to the variety of advanced technology devices and commercial success these companies have in the electronic device industry (Kramer, 2019). It is crucial to be cognizant of existing EADs in order to avoid the red ocean of current EADs and the possibility of developing an EAD that is too advanced for the current market. Additionally, attending trade and market shows assists both the design and marketing department to understand what the competitors are producing. Specifically, the interviewee who is the vice president of commercial design at a computer technology company extols the value and insight gained from trade shows. The interviewee discussed a product that was not successful due to incorrect marketing techniques. This research provides an awareness of the current market and expectations the consumers may have.

Researching EADs revealed one of the most popular and fast-growing types of EAD is the Smart Speakers or Smart Home devices. A key characteristic of most Smart Speakers is voice recognition. This is a potential technology to further study.

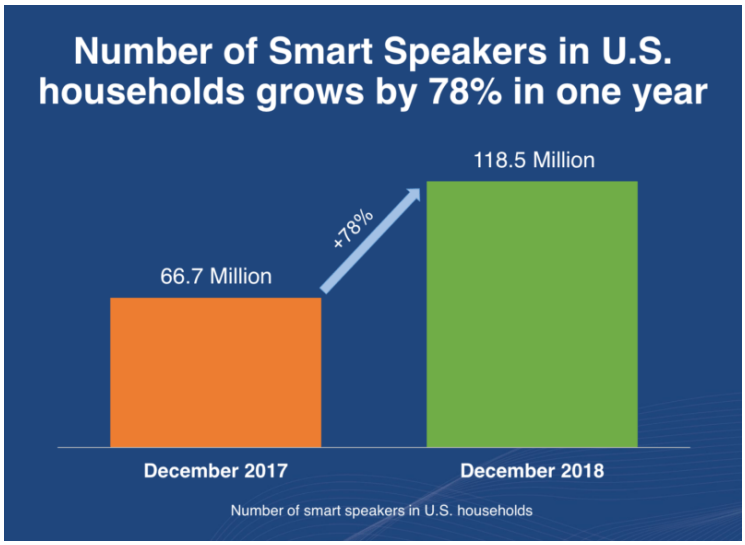


Figure 43. 118 Million Smart Speakers in US (Sterling, 2019)

Notably, in 2017 over 80% of America's reported owning a Smart Phone, and the majority of these devices utilize touch screens. It is important to recognize what technology the American consumers are comfortable with and are likely to expect in a new product (USA Today, 2018). Once data on key features has been collected it can be applied in a product position chart to cross analyze existing EADs' information such as price, quality, and portability. This will assist in finding the market opportunity and understanding consumers' expectations. There are tools and companies that specifically assist the in-market research and the collection of mass data surrounding existing products. This study uses the websites ConsumerReports.org and CNet.com, which provide thousands of detailed reports and rankings of products. ConsumerReports.org also compares and contrasts their data for specific companies. The example below illustrates a ConsumerReports.org comparison of three Smart Speaker devices.

Compare Smart Speakers

	76  **Google** Home Max **Recommended** $299.00 **Shop** Remove from Compare	59  **Apple** HomePod **Recommended** $249.99 **Shop** Remove from Compare	69  **Amazon** Echo Show (2nd Generation) **Best Buy** $229.99 **Shop** Remove from Compare
Ratings			
Overall score (Out of 100)	76 Very Good	59 Good	69 Very Good
Sound quality	Very Good	Very Good	Good
Versatility	Excellent	Good	Excellent
Ease of use	Very Good	Very Good	Very Good
Supported digital assistant(s)	Google	Siri	Alexa
Features & Specs			
Audio format	Stereo	Mono	Stereo
Wireless type	WiFi, Bluetooth	WiFi	WiFi, Bluetooth
Claimed battery life	N/A	N/A	N/A
Dimensions HxWxD	7.75 x 13.25 x 6.25	6.75 x 5.5 x 5.5	6.9 x 9.7 x 4.2
Weight	11.55	5.45	3.9
Supports voice identity	Yes	No	Yes
Optional multi-room sharing	Yes	Yes	Yes

Adjustable tone settings	Yes	Yes	Yes
Speaker phone w/built-in mic	No	Yes	No
Calling	Yes	No	Yes
Texting	No	Yes	Yes
Messaging	No	No	Yes
Accessories	Power supply, Quick Start Guide, Magnetic Base	Quick start guide, warranty.	Power cable
Warranty (mos.): parts/labor	12/12	12/12	12/12
Stereo analog audio input	Yes	No	No
Stereo analog audio output	No	No	No
USB port	Yes	No	No
Other connections	None.	None.	None.

Table 14. Product Analysis Smart Speakers (ConsumerReports.com, 2020)

This information reviews the overall ranking of the EAD and specific features and functions available for the user. Something to note from this data is that the lower ranked EAD, Apple HomePod, does not support voice recognition, calling, messaging, or Bluetooth while the higher ranked products do. These three products are priced within $70 of each other and are relatively compact in size. These products come from three major companies: Google, Apple, and Amazon. The Smart Speakers that are ranked as “Very Good” overall are both ranked as “Excellent” in versatility as well.

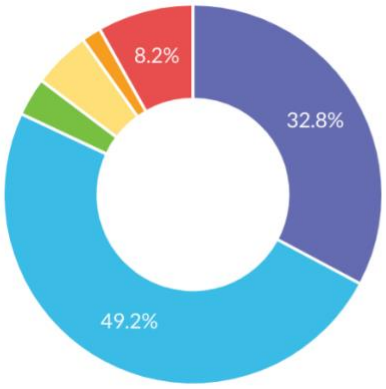
A critical analysis of existing EADs that have been successful in the market helps the marketing team identify the market opportunity. Chapter Two also contains three deep case studies of EADs that have different strengths and weaknesses. That in depth research is not necessary, but it can be helpful to reference. It is beneficial to review a product’s history, material, design, internal components, marketing approach, production system, and packaging in

order to avoid the red ocean market and improve the developing EADs chances of commercial success.

5.2.3. EAD Survey

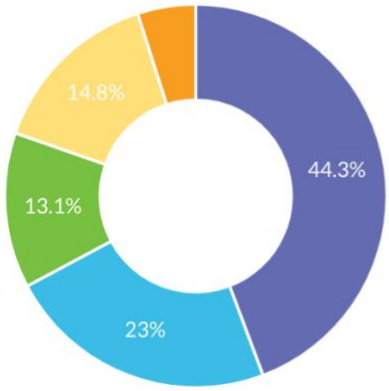
Once the state of the current technology used in existing EADs is understood, the target group can be identified. Digital surveys should be created to gather a variety of responses from a broad range of EAD users and potential users that identified the target group and their product preferences. Following the guidelines in Chapter Four, at this stage, an online survey of less than 10 multiple choice questions will make the responses quicker and easier to comprehend and document. There were a total of 61 participants in the survey conducted for this design exercise. An actual survey by a company should have hundreds or even thousands of participant responses (Piroska, n.d.). For the purpose of this demonstration and given the time constraints, there were less than a 100. The results will identity a market of consumers who may be in need of a new EAD as well as key information as to the features that are important to them. The respondents are all anonymous and their responses are collated to provide the data that supports marketing and design decisions. The questions used in this survey can be used as they are, built upon, or tweaked for different EAD design objectives. For this study PlanetSurvery.com was used to build the survey. The questions used are listed below along with the results.

1) How old are you?



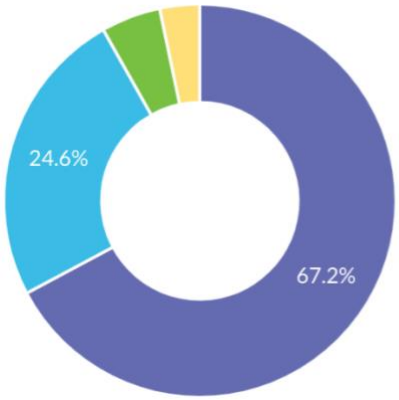
Choice	Total
24-30	30
18-23	20
60+	5
40-49	3
31-39	2
50-59	1

2) When do you use an audio device the most?



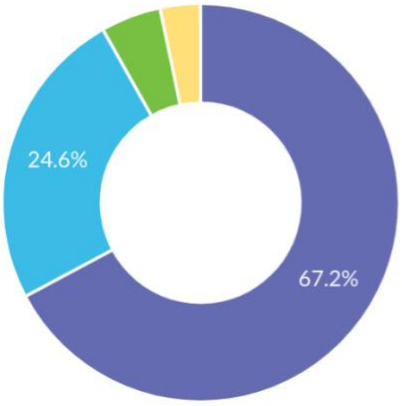
Choice	Total
Commuting/Travel	27
During work	14
Free time	9
Exercising	8
Other	3

3) How regularly do you use an audio-based device?



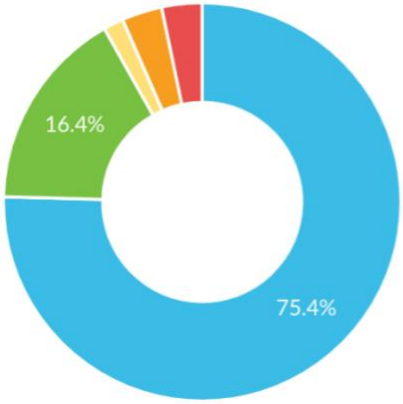
Choice	Total
Daily	41
3-5 a week	15
bi-weekly	3
monthly	2
Other	0

4) Is it portable or stationary?



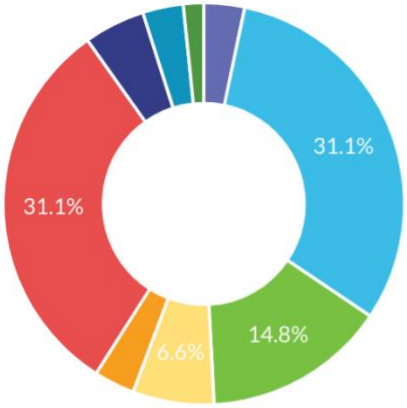
Choice	Total
Daily	41
3-5 a week	15
bi-weekly	3
monthly	2
Other	0

5) What do you listen to most often?



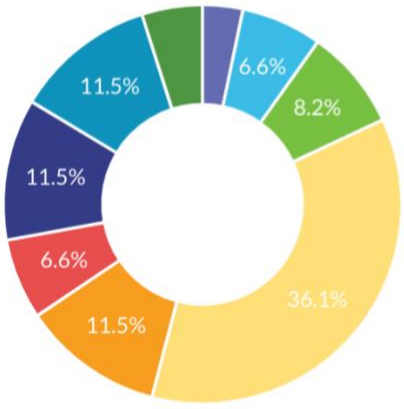
Choice	Total
Music	46
Podcasts	10
Other	2
Radio	2
Audio Books	1
News	0

6) What is your favorite part about the audio device?



Choice	Total
Easy to Use (User Interface)	19
Technology features (Bluetooth, Internet, voice recongition, etc)	19
Audio Quality	9
Energy lifespan	4
Brand	3
Durability/Material	2
Looks/Color	2
Storage capacity	2
Other	1

7) What is your least favorite part about the audio device?



Choice	Total
Energy lifespan	22
Storage capacity	7
Brand	7
Durability/Material	7
Audio Quality	5
Technology features (Bluetooth, Internet, voice recongition, etc)	4
User Interface	4
Other	3
Looks/Color	2

The main takeaway from the survey was that over half of the participants were digital natives between the ages 24 to 30, while another 33% were between the ages of 18 to 23. Almost half of the interviewees stated the most common time of day for using an EAD was during their commute or while traveling. About 67% stated they use their audio device daily and 78% of the interviewees considered their device to be portable. The most common media consumed were music and podcasts. The three favorite aspects of their EAD were the user interface (31%), technology features such as Bluetooth or voice recognition (31%), and audio quality (15%). In contrast, their least favorite characteristics of their EADs were the limited energy lifespan (36%), durability (12%), storage capability (12%), and brand (12%). This data allows the marketing team to develop a target group built around the prevalent responses and their implicit needs. Identifying the market opportunity sets the foundation for the EAD's objectives which in turn helps define the design.

5.2.4. Target Group Findings and Assumptions

The target group identified in this study derives from a weeklong survey consisting of 61 participants where areas of opportunity were revealed. The selected group has been named "Commuters" and will be given a persona to assist in visualizing their routines and their EAD needs. As the name implies, the Commuters are often traveling and live an on-the-go lifestyle. They show more interest in the EAD delivering their needs, playing audio on-the-go, than other desires for the EAD such as audio quality. The EAD is more utilitarian than a decorative product. The Commuters are very likely to be using their EAD while multi-tasking and are likely to not be fully engaged in the EAD and its operations. The EAD will very likely need to be compatible with headphones/earbuds and suitable for travel. Given that the headphones/earbuds will be the

limiting factor for audio quality, the EAD's audio quality only needs to be good enough to ensure that the headphones remain the limiting factor. The marketing team will create a written or visual summary of the expected needs, desires, interests as well as develop a persona for the target group to assist both the marketing and design teams to understand who the EAD is for and what they need or expect in the EAD. It is important for the marketing team to consider these questions pertaining to EADs and communicate them to the design team when they meet to explain the opportunity of the market.

1) How much does the target group (Commuters) want to spend on the EAD?
2) How much storage space do they need? (Audio files, Videos, Audiobooks)
3) What extra features should be included?
4) What size and shape for an EAD is the target group (Commuters) looking for?
5) How would the target group (Commuters) manage and listen to the audio?

Commuters | Bustling

Someone who is on-the-go traveling around, commuting to work, and overall busy.

Target Group - Traveling

Needs & Desire	Needs are more important than desire. Their lifestyle defines the EAD
Audio	Moderate quality, achieve needs, regularly use, likely to be compatible with headphones.
Price Point	Willing to pay low to moderate to fit lifestyle. Aware it may get broken/lost.

Technology - Simple/Clear

UX/UI	Fast, easy to use on the go, minimal toggling
Features	Moderate to limited features. Focus of users need-- play audio. Games and apps to pass the time. Could include Bluetooth, voice recognition, internet.
Energy Source	Battery/DC powered, chargeable for travel. Desire- lasting battery

EAD Design - Modern/current

Form	Moderate form easy to understand. Lightweight. Portable
Semantics	Straight forward - limited possibilities with interface, symbols/icons, graphics, touch screen. Few physical buttons due to the range of environments.
Color	Personalization to stand out for travel or classic colors to keep it discrete from stealing.
Materials	Durable: Moderate to lasting depending due to a range of scenarios. Metal or plastic.

Figure 44. Target Group

According to the survey, the interviewees showed interest in the UX/UI, features, and battery life. Those aspects were either their favorite or least favorite part of their current EAD. The Commuter values an easy-to-use interface as they are likely to be multi-tasking, such as walking, driving a car, and maneuvering crowds. They would rather not want to spend much time toggling through the device and be distracted from their main activating, commuting. An EAD with a concise and easy to use UX/UI would be preferable.

Once the target group is furthered researched, the marketing team will review and analyze existing EADs that are focused on portability. Earlier in this chapter, the research on existing EADs was focused around the most current, popular EADs: Smart Speakers and Smart Homes. On the following page is a secondary product analysis focusing on handheld, portable EADs. One of the products featured is the Clip Jam Sport Plus, which is a similar EAD to the SanDisk Clip Jam MP3 player but is a more recent version of the series.

	 **iPod Touch (7th Gen)**	 **Sony NW-A45 Walkman**	 **COWON PLENUE D**	 **Clip Jam Sport Plus**
Communication Capabilities	FaceTime, Text	no	no	no
Price	$199	$220	$160	$49.99
Storage	32GB, (128GB, 256GB)	16GB (Expandable)	32 GB (Expandable)	8GB (16GB)
battery	40hrs of audio, 8hrs of video	45hrs of audio	100hrs of audio	20hrs of audio
Camera	Yes	no	no	no
Video	yes	no	no	no
WiFi	Yes	no	no	no
Bluetooth	yes	yes	no	yes
Material	Aluminum	Aluminum	Aluminum	Plastic
Weight	3.10 ounces	7.7 Ounces	3.3. Ounces	1.28 Ounces
Screen Size	4.7in touchscreen	3.1in Touchscreen	2.8 in Touchscreen	N/A est. 1in No Touchscreen
Speaker	Built-in	No	no	no
Headphone Jack	Yes	Yes	Yes	yes
Other Features	Camera, A10 Fusion Chip (Improves gaming and AR Games)	Extremely Compatible audio system, DSEE HX System (Restores sound lost in audio compression) Ambient Sound Mode, S-Master HX (Amplifies sound Quality)	Extremely Compatible audio system, Jet Effect 5 and BBET (Audio correction from headphones or the environment) 5 - Band DQ	Water Resistant, Compatible with most audio files
Overall	Designed more for children -- "Best Mp3 player"	Designed for audio/music junkies -- "Long Battery and quality"	Sturdy, Compact, lasting battery, and cheaper	Workout focused and wearable -- inexpensive

Table 15. Product Analysis of an MP3 Player

Additionally, Amazon.com was used for the purpose of this study to look over consumer reports. It is extremely accessible and displays public information to source for consumer reports. The company designing EADs may be partnered with another business who collects and refines this data for them. Overall, customer reviews can often share more detail and true or unique experiences versus a website that mass produces brief reviews. On Amazon.com, the iPod touch had 1,390 reviews and had an overall customer ranking of 4.4. out of 5. The Sony Walkman had 460 reviews and ranked 4.3. out of 5. The Cowan had 270 reviews and ranked 4 out 5. Lastly, the Clip Jam Sport Plus has 290 reviews and ranked 4 out of 5.

From this product analysis chart, there are different takeaways and observations that can be made. The iPod is the most popular product and it includes the most features. Someone can use the product to message people, take pictures, and play a variety of games. From reviews, this product is geared more towards children. In contrast, the Sony Walkman and Cowan Plenue D are both focused on daily, long term use and listening due to the audio improvement features on the device and long-lasting play time. The Clip Jam Sport Plus seems like an inexpensive alternative from popular portable EADs. This product is not designed to last as long as the others. The Clip Jam is the outlier made of plastic and no glass screen. Additionally, it is designed around athletic actives, per its name Clip Jam “Sport” Plus. It is the most lightweight EAD out of the selection and has a physical clip to become wearable.

Furthermore, three of the four devices are touchscreen and are made of aluminum. All four of the EADs have no more than six physical buttons. They buttons are very flat or even slightly convex. This avoids accidentally selection and keeps true to the compact, lightweight aesthetic.

The EADs user interface appears to be designed in a minimal format to avoid complexity. This is especially vital on a small screen and body.

5.2.5. Design Takeaways

The overall design of the EAD should be relatively small, lightweight, and extremely portable. The design aesthetics should be minimal, compact, and modern. When the user looks at the EAD, visual observations of the device should suggest it is portable, durable, and reliable. When someone is commuting and traveling there are limited items that they can bring with them. The EAD should not be a burden for the user, but rather a part of their ensemble and suitable for travel, thus making it more desirable and convenient for the user. The design semantics of the EAD should avoid extruded buttons or nobs as they could get caught on clothing or in a pocket or bag and possibly be broken off. The seams where the parts join on the product should be small so as not to collect dirt or lint. Material and finish choices should be made to avoid those that show dirt, smudges, and fingerprints easily but still protect the internal electronics of the EAD. While there are many aspects of design to account for in EAD product design, good market research of the target group has identified that the Commuters use their EADs most often when traveling and the survey results indicate the primary attributes that are most important to them in an EAD - a portable product with a long-lasting battery, durable materials, current technology expectations, and an easy-to-use interface.

Cross-analyzing the survey results identifies other design attributes and features that are less important but that should still be considered - color, storage capacity, and price.

5.3. Define the Electronic Audio Device's Objective – Introduction

Within this section, the approach for defining the EADs objectives and goals will be demonstrated. The design department will further the user research and analyze the target group deeper and learn their daily habits using an EAD through surveys, diagrams, and charts. The marketing team and design team will refine the design criteria and goals for the developing EAD together. Then the design team will begin the development.

5.3.1. Define the Electronic Audio Device's Objective – Demonstration

The second phase to develop a successful EAD is to define the objectives and goals of the EAD. This definition originates from identifying the market through EAD research, user research, and selecting a target group based on that research. Additionally, the designer can use strategies and generate charts from the research. This will assist in defining a guideline for the EADs intended use. Applying the research to a SWOT Chart, Gannt Chart, Heuristic Plan of Action Chart, and/or Hierarchical Tree Structure chart can help the designer and marketing team evaluate the functions, goals, and timeline of the developing EAD. There are other methods to analyze research that can also be used at any time throughout the study to supplement the suggested methods.

Within the Gantt Chart, the project manager (the head of the thesis committee for this study) will approve the designer's timeline and assist in providing resources. In the Gantt chart, milestones, due dates, and other important markers should be noted in the schedule. There is a range of detail the chart can include, but the more descriptive it is makes it more likely to be better understood by the various parties involved, not the least of which are the marketing and

design teams. Shown below is a Gantt chart that includes the research and development phase of creating a successful EAD.

Creating an EAD				Survey Result Due				Prototype Due
	Jan. Week One	Jan. Week two	Jan. Week Three	Jan. Week Four	Feb. Week One	Feb. Week Two	Feb. Week Three	Feb. Week Four
Project Kick off								
EAD Research								
Assemble Resources								
Conduct User Survey								
Analyze Survey Result								
2D Ideation								
3D Prototyping								
Design Revision								
Review with Professor (Project manager)								

Table 16. Gantt Chart – Creating an EAD

For this study, there is a limited amount of time that can be spent on research, surveys, and EAD development. A real-world product design effort would spend more time in this phase, perhaps as long as 6 to 16 months researching, developing, and testing an EAD (Core, 2017).

The second diagram that will help the EAD development effort is the Heuristic Plan of Action Chart. It includes scenarios, questions and answers, and other information pertinent to the EAD. This will assist in mind mapping and planning out the user interface for the product. In the chart, the questions are listed horizontally while the heuristic scenarios are listed vertically.

There are many ways to approach these issues, but the designer and product manager should decide which parts of the device they need to focus on in order to question, learn, and solve to ensure the most successful design.

	Who?	What?	When?	Where?	How?
Need for an EAD	Commuters	Listen to Audio	During travel, mainly to work. Rush Hour - 7:30am to 8:30am and 5:00pm to 6:00pm	Walking, biking, train stations, car rides, etc.	Through a battery powered device that the user can interact with either physically or verbally.
Changing audio selection	The user	UX/UI that allows for the audio change	Continuous during the time of travel	Walking through crowds, biking in traffic, maneuvering subways, driving a car, etc.	Physically (Touch screen or control pad) or verbally
Charging and Powering EAD	The user	The EAD	Once the EAD is depleted of some or all energy	At the charging station. Public space or at home.	Using a corded or cordless charger
Audio Output	The EAD	Releasing Audio	Walking, biking, train stations, car rides, etc.	Most likely through headphones due to Commuter's public environment. Public areas vs a private area.	Either through headphones or a speaker built into the device

Table 17. Heuristic Plan of Action Chart

Analyzing this diagram reveals that the device does not need to be overly designed or contain the latest emerging technologies. It needs to function well in the target group's lifestyle –that is to play audio on-the-go. The EAD should include features such as Bluetooth, Internet/WiFi,

and/or voice recognition for travel situations. In the user survey, the commuters state that they want a device that has a long-lasting and re-chargeable DC battery. In reality the user uses the device two to four hours a day mainly during their commute. This reveals that the most EADs are not convenient to charge. A potential solution is to make charging the EAD more convenient and does not necessarily imply the battery must be longer lasting. The battery should be as long-lasting as possible within the constraints of manufacturability and keeping the device compact and lightweight, but this issue may be solved by making the charging process easier.

Finally, the team should create a Hierarchical Tree Structure chart to assist the design and marketing team visualize where the EAD will be used, what environments it may be interacting with, and scenarios where the product could be used incorrectly or be damaged. Typically, the chart includes five elements to describe the EAD's system concept: environment, system, sub-system, components, and parts.

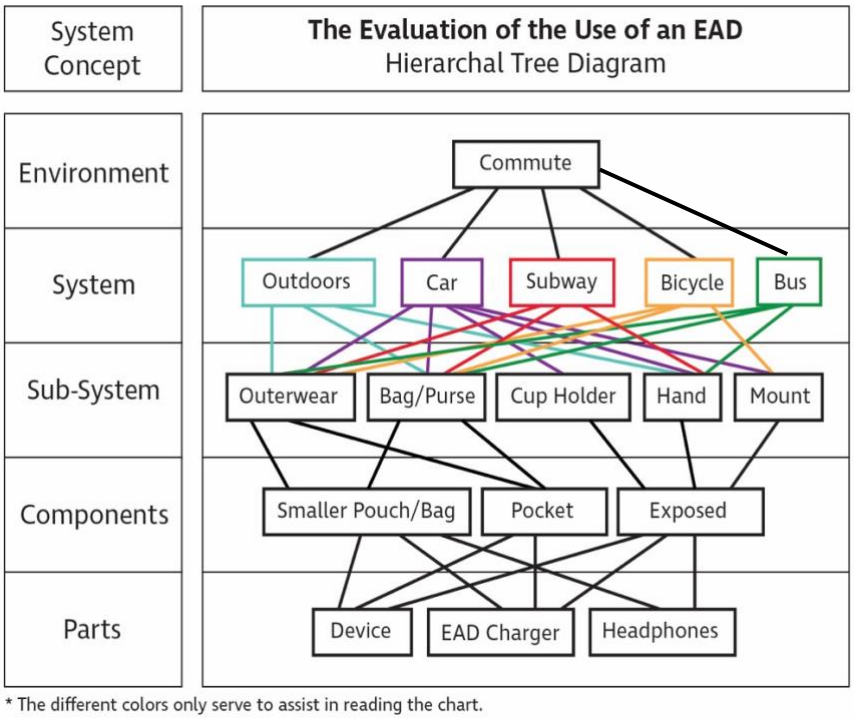


Table 18. Hierarchical Tree Structure

The Hierarchal Tree Diagram assists in visualizing and understanding the different scenarios the EAD could be used in. The Commuters price point expectation will vary due to the multiple scenarios in which it could be used. Some Commuters might prefer a cheaper device because of the likelihood of dropping it, crushing it, losing it, or in general being rough with the product during their travels. Others could be willing to pay a higher price if they believed the product to be of high quality, durable, and offer a longer lasting product. Price was not identified as a primary driver in EAD product selection by the target group in the survey. From the Hierarchical Tree Structure, the areas of use in a car, bus, and metro for an EAD seems to be overdone and flooded with products. For this study, the outdoors and biking are systems that could be an area to explore.

The combination of the Gantt Chart, Heuristic Plan of Action Chart, and the Hierarchical Tree Structure aid in creating criteria for the EAD marketing and design teams by helping them visualize the design process and the required design elements necessary to meet the target group's needs. By understanding the use case environments and the use case sequences, the design and marketing teams are better able to understand what should be included in the EAD design to ensure commercial success. The surveys, charts, and diagrams lead this study to focus on designing an EAD for the outdoors and/or to be used with a bicycle.

At this stage in the study, the EAD design criteria includes features such as a built-in speaker, WiFi, Bluetooth, voice recognition, possible screen or touchscreen, minimal use of physical buttons/knobs, long lasting battery life, easy to charge, durable materials, and completely portable. These aspects may evolve once ideation begins, but they serve as the basis for the initial design and are the underlying design criteria that define the EAD objectives.

5.4. Design a Proper Solution – Introduction

Designing the EAD will be focused around the objectives determined in the previous section and will include some of the functions and features suggested by both the marketing and design department. It is important to keep in mind throughout the design process that there will be design influences within the company and outside of it. This quote from *Design is the Problem* will be something helpful to keep in mind during the design phase and encourage the designer along the way to not constantly expect perfection.

> Every design solution is a compromise of some kind, bowing to structural, financial, or environmental realities, and conforming to customer, market, or client desires. That's the nature of design. If you're creating real solutions for real people, the market will probably not yet be ready for the ultimate solution you envision. (p. 78)

Overall, it is challenging to make a product without being influenced by outside forces and that is okay.

Once the design phase begins, the designer will start developing concepts, sketching, storyboards, and low fidelity models. The designer will consult a material engineer about internal parts, mechanics, and other technology details. The designer will refine the concepts and continue to use storyboards and sequence of use outlines to understand the variety of methods the EAD could be used. The design team will present their early concepts to the marketing team and project manager in order to review the developing ideas. The marketing team and project manager will give the designers feedback and suggestions. These meetings will provide the marketing team, project manager, and others that attend a better understanding of the design

decisions ensure timely and meaningful feedback is provided to the design team. Attending these meetings will also ensure early buy-in on the developing EAD design. It is vital to continue these meetings throughout the early months of the design process to avoid taking steps backward in the design and to prevent confusion among the stakeholders.

As the design process continues, the design team will continue to refine the design and really focus on one design. The designers will create a low fidelity prototype and provide it to a handful of users who will test the product and provide feedback. As mentioned previously in the limitations section, there will be no tradeshow feedback for this project, but at this point in a company's design process the marketing team should participate in a tradeshow to get feedback on the product design and survey the market for similar products on display. After a final round of feedback and input from the stakeholders, the designer will complete any suggested changes to the design that are agreed upon for the developing EAD.

5.4.1. Design a proper Solution – Demonstration

As part of the market analysis a sub-group within the commuter target group was identified that provides a potential gap in the market that we can focus our design to take advantage of the opportunity for portable EADs. Commuting and on-the-go lifestyles identified in the previous section studies show that cycling and workout scenarios appear to be an underserved area of interest. A brief case study for the products in this area of interest will focus on the human function, technical function, and production function of activity based EADs. Researching current technology, form, price, and semantics will assist the marketing and design teams in developing their EAD.

5.4.2. Product Analysis

Since the target group has become more specific, activity and motion focused, another product analysis chart will be helpful in understanding the existing products, avoid replicating them, and understanding the area of opportunity. In creating the chart, the designer will focus on the size, weight, features, audio output, and unique characteristics of the EAD along with other details that become apparent during the course of the study. On the following page the EAD product analysis report below focused on athletic, fast-moving activities such as cycling, walking/hiking, and exercising. These activities still fall within our original target group, commuters, but is more specific and includes other on-the-go activities.

	 **Celtic Blu Speaker**	 **Onforu Portable Speaker**	 **Tech-Life Boom Band**	 **Zulu Audio Speakers**
Price	$80	$18	$50	$40
Amazon Rating	4.4/5	4.5/5	4.1/5	4.4/5
Power Source	Lithium Battery	Lithium Battery	Lithium Battery	Lithium Battery
Audio Storage	MicroSD	Micro SD	None	None
Cycling Mount	Yes, plus Carabiner	Yes, plus carabiner	Wearable	Wearable
Dimension	7x2.5x2.5 in	3.7x3 in	2x2x.06 in	1.8x.75x1.8 in
Weight	1.3lbs	11 ounces	1.6 ounces	8 ounces
Battery	30hrs of audio	10hrs of audio	3hr of audio	4hr of audio
Form	Bottle Shape	circular	wristwatch, compact	small discs, compact
Bluetooth	yes	yes	Yes	yes
Durability	Waterproof, Shockproof	Waterproof, shockproof (silicone case)	Waterproof	N/A
Other	Charge other products, handlebar remote, microphone, FM radio, headphone Jack	headphone jack,	No time display	Microphone for call, magnetic clicks to your clothes
Comments	Great for long bike rides (50,70,130 miles), love the remote and audio quality	Overall good, secure mount, power, audio- - compared to better products that it is just as good.	Poor UX, safe for bike rides, hikes, limited battery life	Safe for runs because audio isn't in your ears, don't pull your clothes down

Table 19. Product Analysis Chart Portable Speaker

The product analysis chart was focused on activity-based EADs. The main takeaways and successful characteristics needed are a lithium battery with at least a 10-hour lifespan, an included SD card slot, circular or somewhat rounded form, must be durability, compact and

lightweight, and including Bluetooth capabilities. An identified area of opportunity is the ability to wear the EAD or mount/attach the product to another surface with a magnetic, plastic, or metal mounting accessory.

Another area of opportunity is incorporating smart home technology. None of the mainstream outdoor EADs currently have that capability. Adding smart home technology and voice recognition would improve the user experience and user safety by making the device hands free. Referencing an earlier EAD product analysis chart, the Apple iPod touch (7th Gen) is one of the bestselling EADs because it is one of the only EADs that includes some sort of communication capabilities with others. As a result of this study the ideation will be focused on active lifestyles and integrating Smart Home capabilities into the working EAD.

5.4.3. Product Ideation

Sketch ideation begins with form and function exploration that references the previous surveys, diagrams, and product analysis charts. An EAD that can be mounted or attached to a surface is successful and unique. Below is a sample of sketch explorations during this design phase. These are quickly done to support initial early discussions with other designers Rusty Lay. The majority of these sketches are speakers and do not require headphones and as such there are no headphones or earbuds in these designs. That EAD market is currently well-established and refined. The forms highlighted here have the most potential at this stage in the design process.

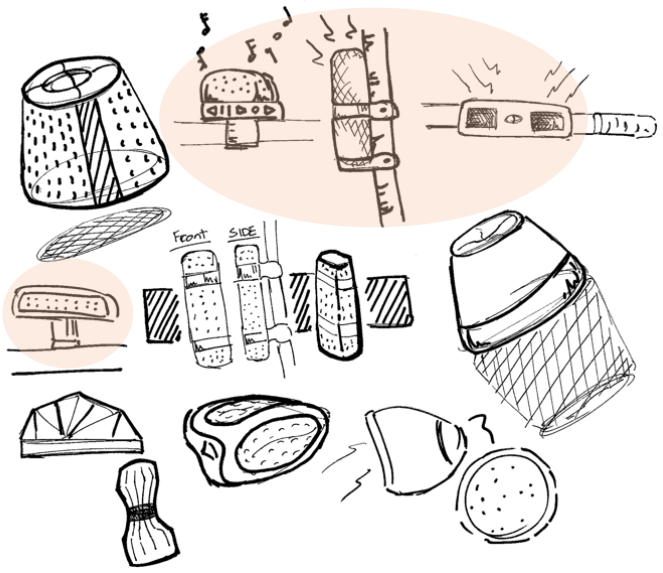


Figure 45. Sketch One

The first sketch includes multiple forms and surfaces that could support audio speakers. There is a focus on cylindrical shapes in order to make the design more ergonomic and comfortable and able to be used by a single hand. These designs could be attached to a bike handle, hung from a backpack, or be wearable. There is a challenge to be original with the use and /or combination of form, features, and function.

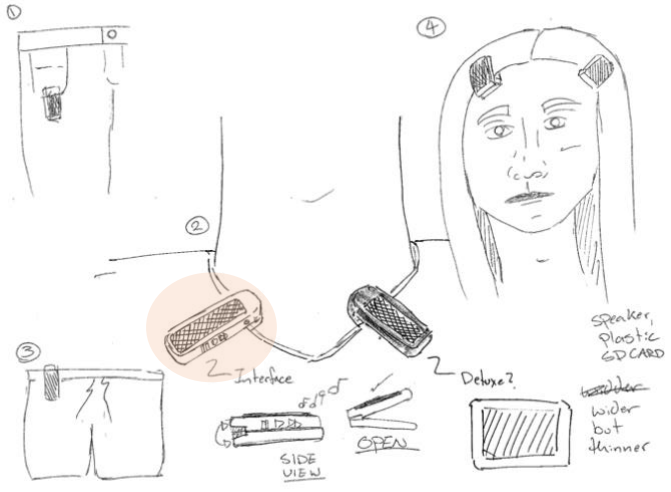


Figure 46. Sketch Two

Sketch two is inspired from the form of the Clip Jam, but without a screen. The top surface is a speaker. This device experiments with attaching to a range of surfaces on a person. Overall, the size of this EAD concept does not seem large enough to be able to produce loud enough audio during an activity although the Tech-Life Boom Band is a similar size and advertises that it produces double the audio sound of current iPhones of 2019. This form is something to consider but needs to be explored further.

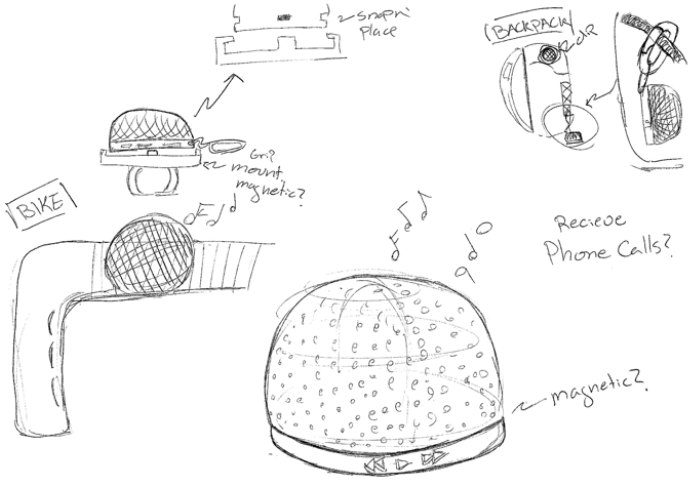


Figure 47. Sketch Three

Sketch three is a dome shape that can be attached to a bike handle or a backpack. The product is made of two main pieces. The top side is the speaker and the bottom half is the player device and the portion that attaches the speaker to a surface. The bottom portion could make use of a strong magnet. Generally, the design lacks innovation and does not appear to push the boundaries of any current EADs already in production and on the market.

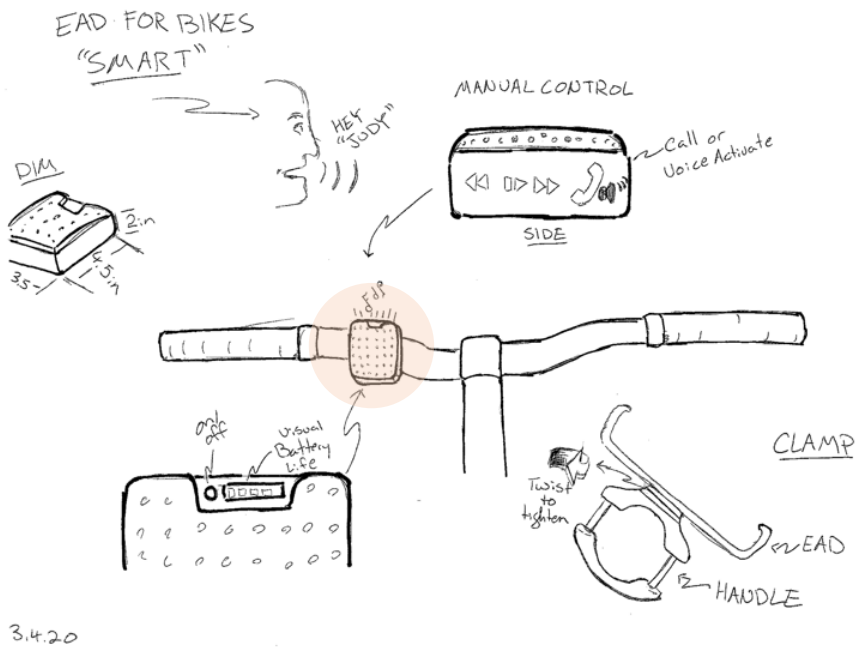


Figure 48. Sketch Four

Sketch four's main focus is to combine Smart Speaker capabilities in a speaker that could be attached to a bicycle. These features could include voice recognition, WiFi, Bluetooth, ability to call and send messages, report about the weather, and GPS. This design has a traditional speaker form and mounting technique. Overall, it seems vital at this stage to include Smart capabilities into the cycling audio devices to improve the user's experience and safety.

During the sketch process it became obvious that there was additional interest in EADs used during active outdoor settings. While reviewing the early sketches, the project manager encouraged more consumer research in that outdoor market, especially a focus on those who have an active commute and live an active life. The indoor EAD designs in the marketplace are cluttered with cellphones, MP3 players, and Smart Homes – none of which are good matches for the active outdoor commuter of our focused target group.

5.4.4. Continuation of Consumer Research

As the design concepts begin to solidify, the designer may recognize the need to obtain more information from members of the target group who are more mobile and active during their commutes. The area of use in cars, metros, and buses are cluttered with existing EADs or cell phones but areas of use where commuters are multi-tasking and are exposed to the outside elements present areas of opportunity and market gaps to develop a successful EAD. The initial survey had the majority responses where the users were listening to EADs in indoor settings or were sitting still during their commute. There needs to be more information on respondents who identify as “outdoor” commuters whose lifestyles are similar to and merge with another sector of consumers who live an active lifestyle outside of their commute. They work out, camp, hike, run, do yoga, and other activities both indoors and outdoors.

This new area of interest indicated that another survey with more specific questions than the first survey be conducted to better identify the important design attributes of this specific target group. The new survey’s questions are directed towards individuals who live an active or outdoor lifestyle. There were 41 responses to the survey during the week it was active. The major themes of the responses are highlighted and those that are most insightful will be referenced and analyzed for this study. These questions were not included in the discussion in Chapter Four but can still be useful for the designer following this approach as it provides additional information on researching market opportunities, target consumer groups, and specific features of developing EADs. All questions below other than questions one and five were short answer in order to allow the “expert” to more fully explain how they use and experience their EAD.

1. Do you somewhat regularly… (Multiple Choice)

a. Run – 21.5% (26 interviewees selected this)
b. Hike – 20.7% (25 interviewees selected this)
c. Lift Weights – 19% (23 interviewees selected this)
d. Cycle – 13.2% (16 interviewees selected this)
e. Camp – 10.7% (13 interviewees selected this)
f. Other – 14.9 % (18 interviewees selected this)
    - Snowboard, Yard Work, Soccer, Tennis, Yoga, Rock Climbing, Surf, HIIT, Swim, CrossFit, and Rollerblade.

Takeaway: There are a variety of user activities and use cases to draw from this survey.

2. Describe when and how you listen to audio during the activity(s).

- A handful of **campers/hikers** mentioned that while they enjoyed listening to their audio device, they did not want to disturb others in the area and used earbuds or headphones exclusively, practicing good camper etiquette.
- A handful of **campers, CrossFit users, weightlifters, and rock climbers,** however, use Bluetooth speakers at a loud volume regardless of their environment.
- A small number of **runners/cyclists** indicated that they prefer no audio during their exercise, as it is distracting and/or cumbersome.
- Several respondents indicated that when they were alone doing activities such as snowboarding or lifting weights, they either specifically select audio to listen to

through earbuds but if they are alone **hiking** or **cycling,** they prefer no audio in order to stay aware of their surroundings.

- There is a fear of **losing** or **damaging** the device during **snowboarding, cycling, or surfing.**
- One user commutes to work on his **bike** and listens to audio to help stay alert during this regular activity and make good use of the commute time.

Takeaway: Overall, if it is a group activity, speakers will often be used contrasting to personal and isolated activities, which tend to include headphones. Additionally, **Bluetooth speakers** and **earbuds** were the most popular EADs mentioned in their responses.

3. What is the name and brand of the specific electronic audio device(s) you use during these times?

Several of the respondents did not know what brand of EAD they were currently using and described them as a cheap or random product they discovered online or in stores. Additionally, some responses were not specific on which model of EAD they use even if they did know the brand.

- **Middleman Devices**: iPad, Apple iPhone, Samsung Phone, Kyocera Duraxv, Apple Watch
- **Headphones/Earbuds**: Panasonic receiver headphones, Jabra active 65t, AirPods, Beats, Jaybird x4, SoundPeats Q30, PowerBeats
- **Speakers**: Milwaukee, Ryobi, JBL 3, Beats pill XL, Ultimate Ears, Soundcore, Bose, Sony Xb41, JBL, Brookstone Big Blue Party,
- **Mp3**: Clip Jam, iPod Shuffle, iPod

Takeaway: Users EAD selection was driven by which activity they were doing. This goes back to the previous point if they were doing something in a group setting, alone, or if the device could be damaged easily during the movement.

4. How do you store or mount the electronic audio device during the activity(s)? (Example: bike handle, in your pocket, hanging from your backpack, etc.)

The response was multiple choice.

- On or in their Clothing – 24
- Placed in the area – 10
- Backpack – 9
- On their person (hand/head/Wrist) – 8
- Bike Handle – 3

Takeaway: The users often use a makeshift technique to store or mount the EAD instead of having a proper place to device or location to store it. Additionally, using the device while in action is a safety concern for many of the interviewees. One response was unique. They 3-D printed a mount to attach to their bike handle for their EAD.

5. Would you consider mounting/attaching your electronic audio device to something to allow easier access?

- I already do – 4
- Yes - 5
- Maybe – 22
- No – 6

- Other – 4

Takeaway: Three out four of the interviewees are open to the idea of using a mount to attach their device to during their activity. The majority of the users are interested in a mount if it improves their user experience and safety while using the EAD.

6. Describe any Challenges you have while using the electronic audio device during the activity(s)?

- The EAD can be hard to control during an activity. Especially when running, cycling, or while wearing gloves.
- The EAD can be too heavy making it easy to drop.
- Accidentally change songs and other settings during an activity.
- The EAD can be damaged by water, rain, or sweat.
- Users feel unaware of battery status.
- The sound range can be limited.
- Cords connected to the EAD can be troublesome.

Takeaway: The EAD weight can be an issue but it is mainly a result of the user storing the device in an improper location, for example, storing it in between a layer of clothing, or between their clothing and their body, or held in their hand. Users also mentioned the inconvenience of using a cellphone as their EAD. Their phone is often too heavy, wastes a lot of their available battery life, and they fear damaging their phone during the activity. Overall EADs should be designed to allow for more hands-free use during activities.

7. Are you ever concerned about your safety while using the device during an activity? (Example: it is a distraction? It prevents you from hearing your surroundings?)

- Unable to hear surroundings while biking, hiking, camping, snowboarding, and/or crossing streets.
- While using the device the user fears they could fall or trip.
- There is a concern of hands being occupied while using the device.

Takeaways: Of the 41 responses, 28 of the interviewees had minimal concerns or none at all about their safety while using their EAD. A handful of users will not listen to audio or keep the volume very low while using their device to be able to hear their surroundings. Others do not want it to be apparent to other people that they are listening to an EAD or that their senses are impaired. The majority of users who were concerned about their safety were hikers, cyclists, and runners and were located in both busy and isolated areas.

8. Are you satisfied with your electronic audio device? Explain why you are, or are not.

For this response I reference their direct quotes.

- "Yes, but I wish it was as small as an iPod Shuffle"
- "…something that mounts to my bike or body and does not move… hear surroundings and good sound quality… speaker or headphones"
- "earbuds are just okay, can't beat the price"
- "I would use it more if it felt higher quality, simpler, and more durable…"
- "Not really, sound quality is amazing… but they are ugly and inconvenient

Takeaway: Multiple users said they were satisfied with their device, but still followed with a suggestion and improvements that could made for their device. There were multiple mentions of hands-free capabilities and improving security of the EAD where it is stored. Many interviewees were content with their EAD if the sound quality was suitable, had long battery life, was durable, and was portable. Headphones appear to cause discomfort to users after an extended amount of time wearing them for most respondents.

9. Are there any features or characteristics you wish your electronic audio device had? Is there an existing electronic audio device you are interested in?

For this response I reference their direct quotes.

- "…wireless earbuds that can double as hearing protection for woodworking"
- "Bose noise cancelling headphones…"
- I wish my audio device (AirPods) could lower and raise the volume handsfree"
- "FitBit features… matches music to my pace…"
- "Different ways of carrying it"
- "I like the bone conductors, but you can't turn them up too high because your skull will ache... weird feeling"

Takeaway: There was a definite interest in improving an EADs ability to adapt to different scenarios from the car to home to backyard. Additionally, numerous responses indicated a desire that the EAD be more compact yet not so small as to make it easier to lose the product. Respondents indicated a desire for their EADs to better visually display battery life and for operation to be handsfree.

In conclusion, there is an area of interest in creating a long lasting, handsfree, and portable EAD. Cyclists fit the target group by commuting to work by bike and also biking gathered from the survey as a mobile recreational activity. Some features and functions that should be included in the developing EAD include water/sweat resistance, voice recognition, smart technology, improved visual affordance, and safety. There is an expressed need for more options and technological advancements for cyclists.

5.4.5. Ideation

After a series of ideation and surveys, the designer has a more refined awareness of what the target groups needs are. As a reminder, the target group are commuters who cycle to work and live an active lifestyle. The designer developed new concepts based on the input and ideation.

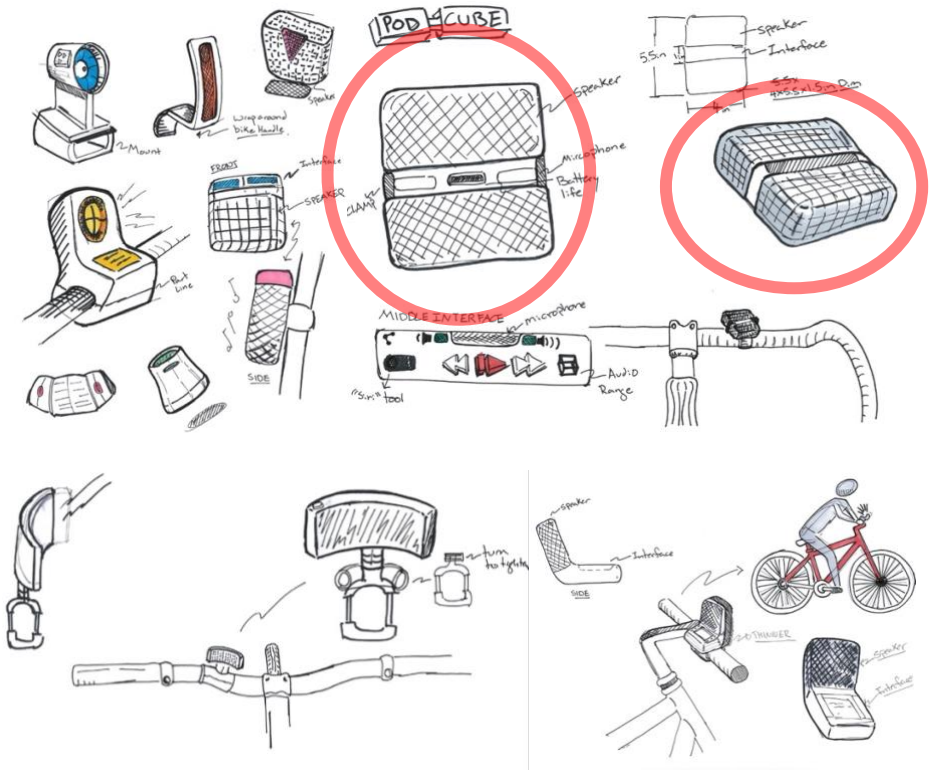


Figure 49. Post-Survey Ideation

After another series of ideation and consulting with the product manager, the square body with curved edges form is a logical and fitting solution for mounting to a bicycle. If it is the appropriate size and provides enough surface area, the device can produce sufficient audio for the user. As the design process continues there will be more ideation, prototype development, and testing of interface configurations.

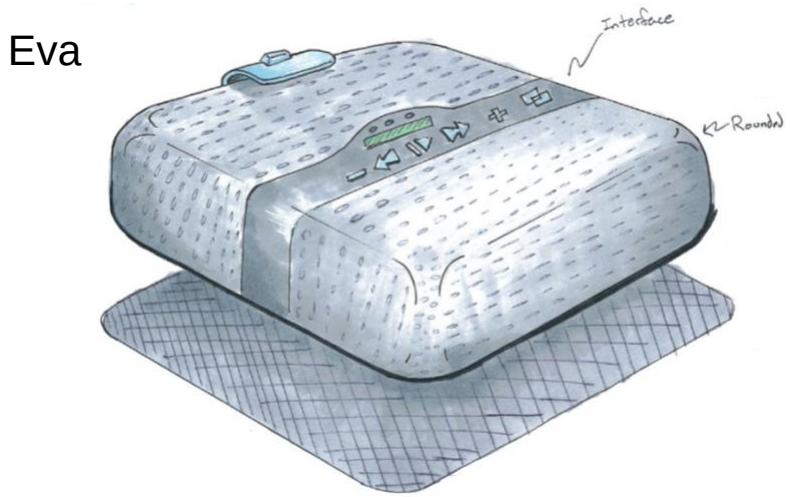


Figure 50. Early Sketch for “Eva” (Not the final model)

The device is called “Eva”. It is a smart speaker for cyclists and has about a 10hr battery life. The device has a range of functions and features. Most importantly it has a SD card slot, the ability to connect to WiFi, Bluetooth, and voice recognition. It can connect to the user’s Smart Phone to connect to the WiFi or function independently similar to the newer models of Apple’s Smart watches and some Smart homes. Some of the key features are; the ability to play audio, make phone calls, send messages, and connect to a GPS. The device will be waterproof and impact resistant to extend the product’s lifespan and durability. The EAD could be created from aluminum, ABS plastic, polycarbonate, silicon, nylon, or other microfibers. The material choice will be decided once the form becomes more refined. The material choice will also be influenced

by the designer's research, suggestions from the design team, and environmental impacts. The goal of Eva is to be a long-lasting durable device, be enjoyable for the user, and improve the user's safety while they bike or participate in other activities.

5.4.6. Mounting the Device

The EAD has three mounting options. The first option is on the back of the device itself; Eva has a screw receptacle for a tripod-like mounting. Eva can be attached to most traditional tripod mounts or other screw-based attachment mounts.

Figure 51. Screw hole Attachment

Eva will also come with a personalized bike mount that is compatible with Eva's dimensions as an alternate way the user could mount Eva to a bicycle. The clamp that connects to the bike handle is based off a traditional bike mount design, but the part that holds Eva is again personalized to fit Eva's dimensions. The clamp wraps around the smooth, speaker free strip around the device. The neck of the device can be twisted to tighten around Eva.

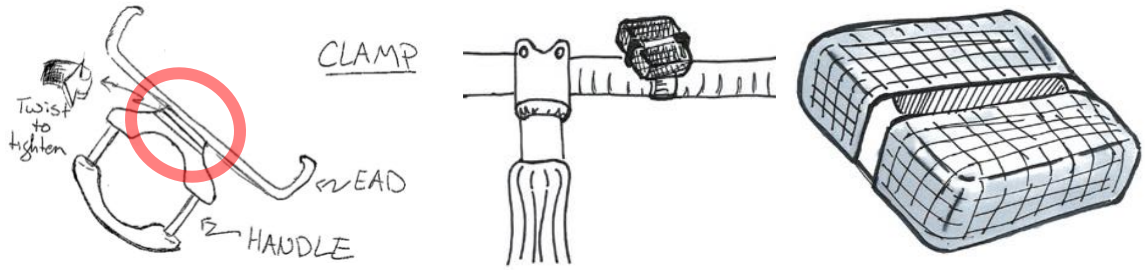


Figure 52. Mounting device Attachment

Eva also has a rubber band, made of fluorocarbon synthetic rubber, on the back. The purpose of the band is to allow the user to attach it to surfaces other than a bike. For example, it can hang from a tree branches in a camp setting, hang in someone's shower, on a backpack strap, or on the frame of someone's bed. The band has a function similar to a watch band or a belt. It has several notches to adjust the length of it to fit onto a range of scenarios.

Figure 53. Rubber band attachment

5.4.7. Interface

The majority of the EAD body is a speaker, but there is one inch of soft plastic wrapping around the middle of the body. On the front side of the device there are manual controls like

pause/play, skip, back, audio volume control, and an environmental setting, as well as a battery bar to communicate to the user the status of the battery. These key functions are all located on the front for easy access by the user. The surveys indicated that there were multiple users who struggled to use their device during their activity. The design of the user interface incorporates this feedback.

The topside of Eva has the on/off button and the Bluetooth connection. These buttons are placed on the top side of the device to prevent the user from accidentally pressing them and disrupting their use of Eva.

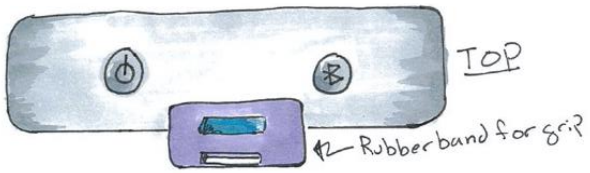


Figure 54. The interface – Top Side

The front face of Eva includes the volume, skip, stop/play, battery indicator, audio environment setting, and microphone. The battery bar uses scale and colors, green, yellow, and red to communicate Eva's battery life. These colors are universal and represent fully charged, partially charged, and low/no charge. The bar will also shrink in length to communicate to those who have limited color vision. Visual battery life indicator was a common theme in the surveys. The  shapes represent the "skip" command. The shape is minimal to reduce visual clutter. Due to their placement next to the play/pause button it is unlikely the user can assume the purpose of the "skip" button. This button,  , represents the audio environment setting option.

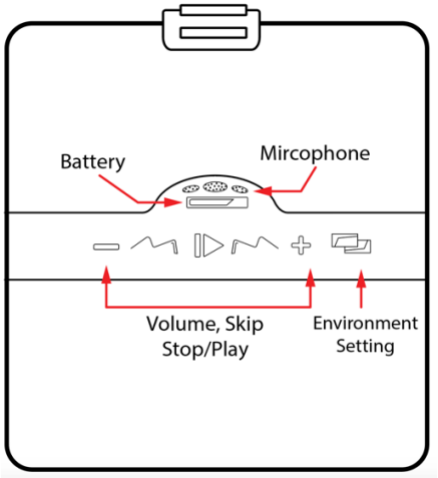


Figure 55. The interface – Front Face

The environmental setting button is a special feature of the Eva. It has four audio settings: almost silent, personal, working out, and group. If a user is concerned about the volume, their safety, or disturbing others around them these presets can help the user quickly toggle through a range of volumes. The user can either manually select the environment setting or by voice command. The setting is an ambient option is a low audio volume that can be heard in about a 5ft radius. The goal of this setting is for the user to only hear the audio and for it to not disturb or be heard by any potential neighbor. Additionally, the user will be able to hear their surroundings while the audio is playing. This concept of the environment setting derived from the input in the user survey.

5.4.8. Dimensions

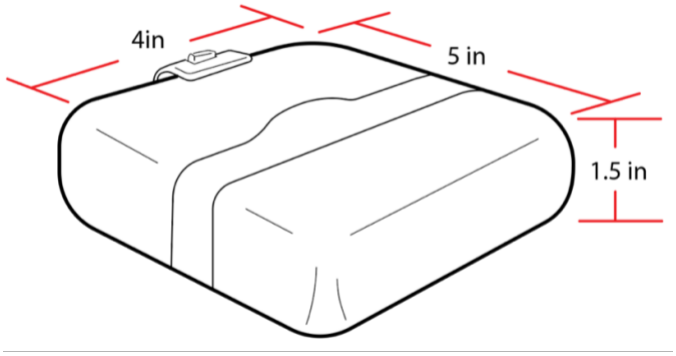


Figure 56. Early Dimensions

Initially, Eva was going to be 5 inches, 4 inches in width, and 1.5 inches in depth. After creating a physical prototype, Eva shrunk in size to be 4 inches in height by 4 inches in width as seen below.

Figure 57. Eva Prototypes

The top surface is barely larger than the newest iPhone X which is 5.75 in height, 2.8 inches wide. The size of the device was determined studying the available space on bicycle handlebars using prototypes. It is a familiar size for the user and fits within the limited handlebar space.

5.4.9. Eva Refinement

After testing the device with two users a problem was discovered. Eva was still too bulky on the handle, even though it fit within the allowed space.

Figure 58. Prototype Testing

Additionally, after beginning 3D digital modeling the interface needed to be rearranged even though the body became smaller. The revised version of the form is 3 inches by 3 inches.

Figure 59. Prototype Ideation

After another series of prototyping and conversations with the test group it was observed that Eva needs to become even smaller.

Another series of prototypes were designed, and two compact forms of Eva were developed. Overall the function and features are both the same, but they are more narrow than previous models. The main difference between model A and model B is the width. Model A is

2.5 inches wide while model B is 2 inches wide. Realistically to have the 10-hour battery lifespan, audio volume, “Smart” features, and physical controls Eva needs to be 2.5 inches wide.

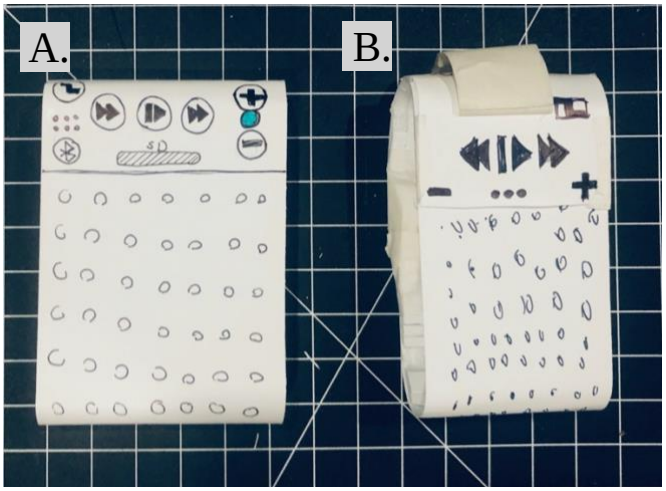


Figure 60. Prototype Refinement

Before making a final decision both models were placed on a bicycle handlebar for another assessment focused on scale.

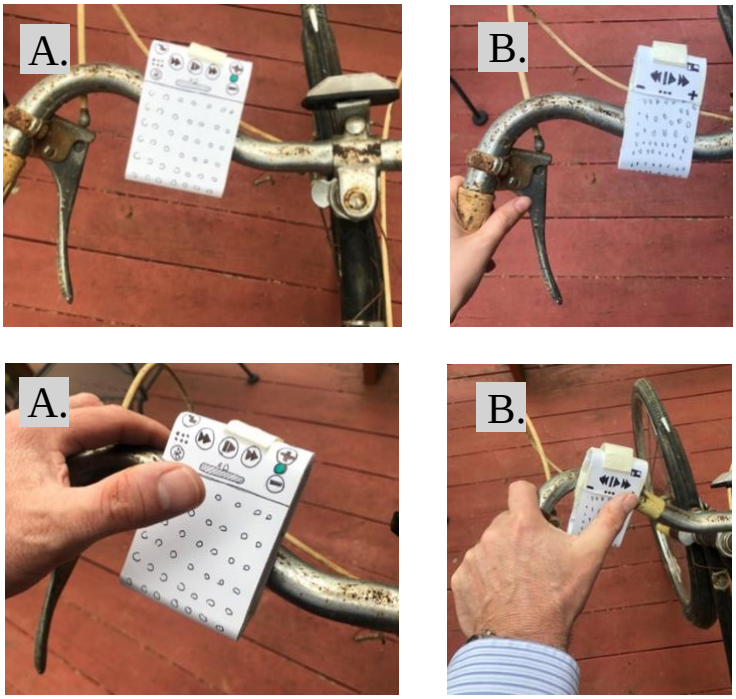


Figure 61. In context – **Model A** 2.5 inches wide, **Model B** 2 inches wide

After user testing and consultation with the project manager, prototype A is the form that will be pursued. The 2.5-inch width fits well on the typical bike handle and is still a compact, handheld size and lightweight enough to hang from other surfaces like a backpack. Additionally, the slightly larger body will make it easier to fit the internal technology components inside and enable the outer controls to be easier to operate. An additional benefit of the 2.5-inch width is it will keep the costs down and ensure that the audio volume is powerful enough.

Figure 62. Eva Front View

After changing form some of the mounting techniques and user interface was altered. Earlier in the design process there were three attachment techniques for the Eva but now there will be only two, the tripod mount and the rubber band.

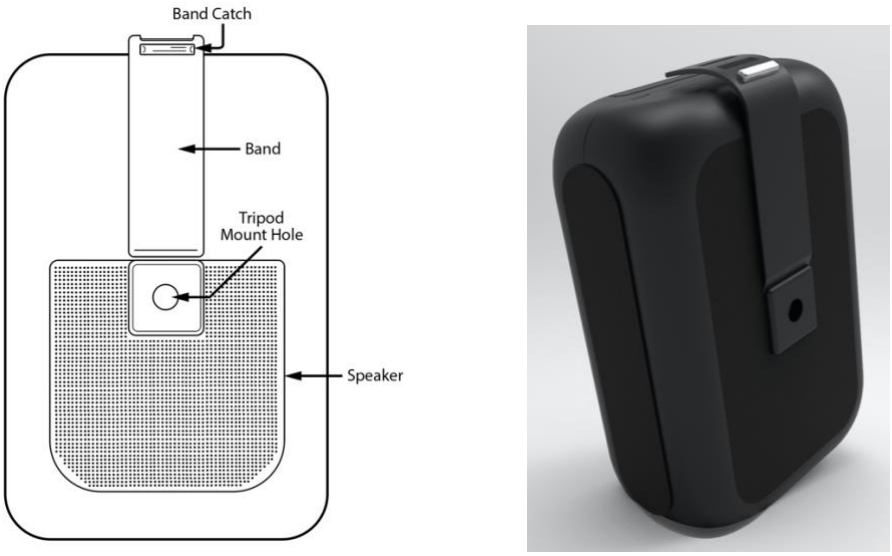


Figure 63. Eva Back View (Highlighting the two attachment options)

As a part of the design process, a range of existing bike mounts were reviewed and examined to see how compatible they were with Eva. The one that was selected is produced by a company called Conxtrue in Kentucky. It is simple to use, compatible with most bicycles handles, and is sold at a fair price (less than $10). Eva's production team will source this specific bike mount from Conxtrue and pair it with the Eva. The mount will be sold with Eva to eliminate the extra step for the user when searching and purchasing a bicycle mount.

Figure 64. Mounting on Bike Handle - Final Eva

The second attachment technique is the rubber band on the back. This allows Eva to be multifunctional in a variety of scenarios. Below, the in context was demonstrated on a backpack. The rubber band has the function of a carabiner but can be adjusted like a belt or watch.

Figure 65. Attachment Feature - Final Eva

The physical buttons now curve outward from the device and have the symbols printed on them. These design features will assist the users identifying and operating the buttons during their activities. The tactile feeling of the button actually moving when pressed communicates to the user that they are pressing on a button and provides feedback that it is performing the selected function. The skip and environment buttons' symbols have been simplified to improve user recognition. The physical interface includes the stop/play, skip, volume, bluetooth, environment setting, and on/off. The volume, play, and skip buttons are combined together in a diamond like shape to improve the blind control due to their positioning.

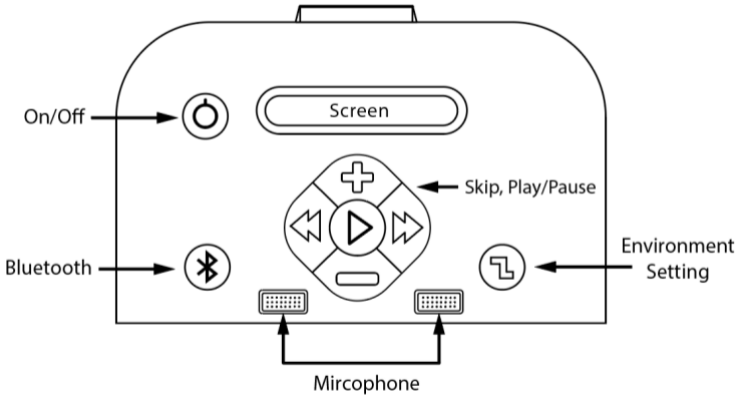


Figure 66. Eva Front Interface

These function commands are vital for the device to function if the user does not want to solely use the voice commands. Another design change is focused around the screen. It will indicate what song is playing, assist in GPS navigation, and indicate the battery levels.

Finally, the SD card slot was moved from the side of the body to the top face of Eva. It was moved in order to keep the front side from becoming cluttered and since the SD card will not be accessed as regularly as the other functions. Overall the functions and features remain the same but due to the body size shrinking the interface was rearranged accordingly.

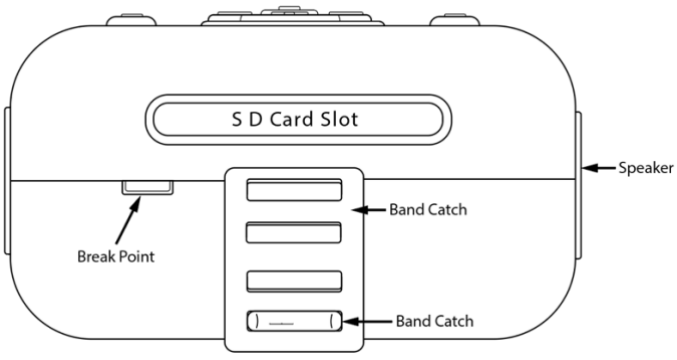


Figure 67. Eva Top Interface

This iteration of the design has yielded a final design that will allow the marketing and graphic design teams to take over and refine the message, visuals, and packaging of the product. The design team will create a final outline of Eva's functions and features to ensure the

marketing team has the most accurate data. The marketing team is aware of the goals of the EAD and have been kept updated throughout the design process in meetings with the design team. The marketing team will refine the marketing strategy, advertising messaging, online and storefront markets and price points for the product to ensure it actively engages the target group. There will be meetings with the design team and product manager to make minor changes to the strategies along the way instead of waiting and having to make major changes at the end of the marketing effort.

Eva was designed so the user could take it apart if they needed to repair it or discard of the internal parts responsibly. There is a break point where a flat head screwdriver could be used to crack open the outer shell. The plastic snap and groove shell will open up and the majority of the internal mechanics and the speakers are connected to the top half of Eva. This lets the user repair and examine the internal parts instead of purchasing a new device altogether. If the user is ready to depose of Eva, they could take it apart and responsibly sort and depose of the e-waste. Overall, this ability is centered about making Eva more environmentally friendly, sustainable, and lowering the product's carbon waste. It could lengthen the lifespan of Eva and potentially create less harmful waste.

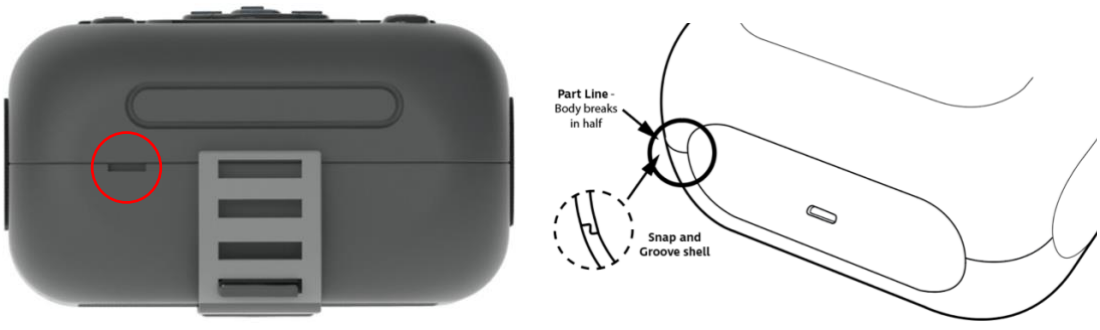


Figure 68. Break Point

5.4.10. Eva Conclusion

Eva is an outdoor smart speaker specifically designed and marketed for cycling use and other outdoor/indoor activities. It holds a charge for up to 10 hours and is shock resistant and waterproof. Eva can store 16GB of audio, but the storage is expandable with the use of an SD card. Eva's body is made of a flexible plastic to provide its shock resistant characteristics and has a plastic speaker mesh. Eva delivers high-fidelity audio by using a 3W audio driver that has anti-clipping technology to limit distortion. Eva uses Bluetooth 5.0, which gives the user a more stable connection and enables hands free calls and to be notified when they receive messages. Eva is a compact design, 3.3 inches in height, 2.5 inches in width, and 1.3 inches in depth. When the battery is depleted a micro USB charger can be plugged into the base of Eva for recharging.

Figure 69. Eva Color Variation

Eva comes in four colors, midnight gray, red, teal, and a vibrant purple. These colors are in the top seven color choices for technology according to 99 Designs. Additionally, customer reviews explicitly mention those colors as the ones most users desire. A digital 3-D model of Eva in midnight gray is shown below. The back view shows a mounting point on the center and the notches for the rubber band that can extend for other scenarios.

Figure 70. Eva Portable Smart Speaker

The marketing team will finalize Eva's advertising message and collaborate with the graphic design team and structural engineers on the graphics, packaging, and shipping locations through weekly meetings as the product comes to market. The marketing team will use storyboards or sequence of use charts from the design team to assist them in ensuring the goals are met during the meetings.

Eva is expected to be priced in the $50 - $75 range and fall in the sweet spot for tech products with a 5-year average life span. In the book Okala *Learning Ecological Design,* Chapter 10, it suggests that audio systems wear out in about 9 years but become obsolete in technology in 4 years. Therefore Eva should meet somewhere in the middle. It will have a lower wear out life than what the book suggested because it is an outdoor, mobile audio device. Wear out life is used to calculate the life cycle impacts of products. The technology cycle indicates how soon the technology used in the product is significantly modified.

Product	Wear-out life (in years)	Technology cycle (in years)
audio system	9	4
automobile	20	7
bubblejet printer	8	5
cellular phone	3	1
computer	6	2
computer mouse	6	4
cordless phone	10	5
CRT display	6	3
digital copier	5	2
fax machine	6	2
hand held vacuum	4	6
inkjet printer	4	2
laserjet printer	8	5
LCD display	5	2
miniature robot	5	5
photocopier	5	5
portable CD player	5	10
portable radio	10	2
single use camera	2	4
telephone	5	2
television	11	4
typewriter	15	9
vacuum cleaner	8	7
video projector	5	2
washing machine	10	5

Figure 71. Typical Product Lifetimes (White, 2009)

5.5. Post-Production Review

In post-production the company evaluates Eva's sales, customer reviews, and the new technology to identify areas requiring change. The changes should focus around the form, function, and features that could be incorporated into the next version of Eva to improve it based

on feedback from customers and the internal team. A limitation of this study is that Eva cannot be mass produced, critiqued, or receive customer reviews thus the post-production insight is limited.

With rapid technology advancements, according to Moore's Law, Eva will become more lightweight in a future version but retain its power. As time passes the newer, more compact Eva will become more adaptable and useful in different use case scenarios. Eva may be more appealing to different groups like professional cyclists or other athletes which could result in a marketing shift for Eva.

Other than slimming down the device, there could be other design changes for Eva. Potentially the tripod mount could be extruded further from the body. The band and the mount could possibly interfere with the user attaching it to their mount after repeated use. Additionally, further strength tests should take place with the band.

Finally, in post-production there could be further conversations with experts in technology, engineering, and with the target group cyclists to help reshape and improve the device. Additional durability tests could be performed such as drop tests, which would inform design changes to improve durability. Information could be gathered on which parts or materials fail most and how the internal component might be reconfigured to enhance performance or durability.

Overall, as time passes Eva will need to be refined and updated. Technology, society, and manufacturing techniques are always changing. A statement from the book *Design is the Problem* by Nathan Shedroff (2009) summarizes this well. "You won't ever create a perfect solution. Ever. You will have to be satisfied with creating better solutions along the way—each update, hopefully, better than the rest…" (p.78).

Chapter Six

Conclusion

6.1. Limitations

Due to the time constraints of this study, there are limits to the real-world applications applied to this study. The demonstrations in Chapter Five are limited by the time of the academic calendar, attending trade shows, resources, and consulting to company co-workers, whereas an actual company would only be limited by constraints within the company such as resources or timing of the market opportunity.

Additionally, given that the lifespan of an EAD can be anywhere from one to twenty years depending on how well it is designed, built, maintained, and supported, there can be challenges for a company that creates a long-lasting product to maintain sales and a steady ROI. This study focuses on marketing and design but does not entirely flesh out the study of sales and the factors that might impact design decisions such as product life spans. One of the case studies include an EAD that has been on the market for over three decades and still commands market share, but not every company will produce a product that exists in that unique situation. Investigating decades-long-enduring EADs from this study would require more research than was available for this study; companies applying this approach to their EAD development and production would likely need years to adequately study this factor.

6.2. Summary

This study provides evidence of the critical importance of a coordinated marketing and design team effort to successfully develop electronic audio devices. Throughout this study the research, interviews, detailed case studies documented, demonstrated approach fully support the thesis that marketing and design team linkage are important. It is unlikely for an EAD to be commercially successful without coordinated and thoughtful design and marketing strategies. The design and technology can be simple like the Clip Jam or be elegant like the Zune HD, but without researching, considering the market and user preferences in both the design and marketing efforts commercial success is doubtful.

The EAD industry requires tight coupling of the marketing and design team in order to design and launch a commercially successful product. The linkage between marketing and design in EADs is more critical than many other industries due to the rapid emergence of technology across the EAD and broader electronic device markets. In order to gain market share in the competitive EAD industry a product must have a well thought out marketing plan as well as a thoughtful design. The design must meet the needs and desires of the target consumer group and be coupled with a marketing plan that takes those same things into consideration. A company or designer using this approach will benefit from utilizing the strategies and methodology described here to develop a commercially successful EAD product.

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