

EXPLORING THE IMPACT OF DIGITAL TEXTILE PRINTS ON  
IDENTITY EXPRESSION IN WOMEN BREAST CANCER  
SURVIVORS

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the Faculty of the Graduate School  
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In Partial Fulfillment  
of the Requirements for the Degree  
Doctor of Philosophy

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by  
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The undersigned, appointed by the dean of the Graduate School, have examined the dissertation entitled

EXPLORING THE IMPACT OF DIGITAL TEXTILE PRINTS ON IDENTITY  
EXPRESSION IN WOMEN BREAST CANCER SURVIVORS

presented by Nicole Star Eckerson,

a candidate for the degree of doctor of philosophy,

and hereby certify that, in their opinion, it is worthy of acceptance.

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## TABLE OF CONTENTS

<b>ACKNOWLEDGMENTS</b> .....	ii
<b>LIST OF TABLES</b> .....	xi
<b>LIST OF FIGURES</b> .....	xii
<b>ABSTRACT</b> .....	xiv
<b>CHAPTER I: INTRODUCTION</b> .....	1
Background of the Study.....	1
Purpose of the Study.....	6
Significance of the Study.....	6
Definition of Key Terms.....	8
Organization of the Study.....	9
<b>CHAPTER II: LITERATURE REVIEW</b> .....	11
Theoretical Frameworks.....	11
Public, Private, and Secret Self (PPSS) Model.....	12
Design and Emotion.....	14
Emotional Design Theory (EDT).....	15
Limitations of EDT.....	21
Application of EDT.....	22
User Involvement and EDT.....	22
Interaction Between Product and User.....	23
Consumption Practices.....	23
Self-identity and Product Attachment.....	24
Product Experience.....	26

Co-design and User Involvement in Developing Products.....	27
The Importance of Pleasure on Emotional Response to Design.....	29
Emotions and Color.....	33
Visual Images and Emotional Messages.....	34
Identity Through Dress.....	36
Gaps in the literature and research questions.....	38
<b>CHAPTER III: METHODS.....</b>	<b>40</b>
Research Approach.....	40
Data Collection - Rationale.....	43
Phase I: Screening Survey.....	44
Phase II: DTP Evaluation.....	45
Phase III: Exit Interview.....	46
Recruitment and Participants.....	47
Data Collection - Measures.....	49
Phase I: Screening Survey.....	50
Phase II: DTP Evaluation.....	53
Phase III: Exit Interview.....	56
Data Analysis.....	57
Solo Coding and Trustworthiness.....	57
Credibility.....	59
Transferability.....	60
Dependability.....	61
Confirmability.....	62

First and Second Round Coding Process and Codebook.....	62
Key Data Analysis Goals for Each Study Phase.....	64
<b>CHAPTER IV: RESULTS.....</b>	<b>65</b>
The Role of Textile Prints: To Communicate Public, Private, and Secret Self.....	65
Public Self.....	68
Private Self.....	71
Expressing Breast Cancer Survivorship.....	71
Exclusivity of Individualized DTP Designs.....	77
Secret Self.....	79
Negotiating Breast Cancer Through Public, Private, and Secret Self.....	82
Factors That Breast Cancer Survivor’s Draw Upon When Evaluating Digital Textile Print Design Choices: Visceral, Behavioral, Reflective, and Emotions.....	83
Visceral.....	86
Wearable Color.....	86
Contrast in Color.....	90
Identifiable Imagery.....	92
Behavioral.....	98
Design Enhances Emotions.....	98
Wearability Predictions.....	103
Reflective.....	107
Values Represented in DTP.....	108
Closure Through DTP.....	115
<b>CHAPTER V: CONCLUSIONS.....</b>	<b>124</b>

Overview of Study.....	124
Research Goals and Objectives.....	124
Literature Gaps.....	125
Justification.....	125
Summary of Findings.....	127
Identity Expression in DTP.....	127
DTP Evaluation.....	128
Contributions and Implications.....	133
Public, Private, and Secret Self Model.....	134
Emotional Design Theory (EDT).....	135
Implications.....	137
Limitations and Future Research.....	140
Limitations.....	140
Future Research.....	143
Research Reflection.....	145
Co-design Process.....	145
Reflection on Study Design.....	147
<b>REFERENCES.....</b>	<b>149</b>
<b>APPENDIX A.....</b>	<b>159</b>
<b>APPENDIX B.....</b>	<b>160</b>
<b>APPENDIX C.....</b>	<b>175</b>
<b>APPENDIX D.....</b>	<b>176</b>
<b>VITA.....</b>	<b>179</b>

## LIST OF TABLES

<b>Table</b>		<b>Page</b>
1.	Definitions of Key Terms.....	8
2.	Dress as it Relates to the Public, Private, And Secret Self Model.....	13
3.1	Participant Summary of Information.....	48
3.2	Trustworthiness in study design.....	58
4.	Final outcomes of participants DTP scarves demonstrating how self was represented through photographs used.....	66

## LIST OF FIGURES

<b>Figure</b>	<b>Page</b>
2.1 Diagram of how the central phenomena is supported by DTP, EDT, PPSS, and UCD.....	12
2.2 Emotional Design Theory where the designer’s view of the product differs from the User’s view.....	17
2.3 Venn EDT diagram demonstrating how the visceral, behavioral, and reflective levels are interconnected.....	21
2.4 Original digital textile print designed by researcher Eckerson (2020) .....	31
3.1 Research Study Design Diagram.....	40
4.1 Michelle’s DTP Scarf.....	69
4.2 Examples of public expression in DTP scarf use during wear trial testing provided in journal.....	71
4.3 Chelsea’s DTP Scarf.....	73
4.4 Chelsea’s DTP Prototypes.....	76
4.5 Natalie’s Chosen Print Reflected in Journal.....	78
4.6 Veronica’s DTP Prototypes.....	79
4.7 Cynthia’s DTP Scarf Design.....	82
4.8 Top three ranked DTP prototypes and corresponding original photos for each participant.....	84
4.9 Progression of colors in DTP designs for Michelle.....	88
4.10 Muted tones of Grand Canyon and Daughter for Chelsea.....	89
4.11 Original colors of photographs enhanced to show contrast in color in DTP scarf.....	91
4.12 Natalie’s example of clear and contrasting colors.....	92
4.13 Chelsea’s image criteria when evaluating one of her DTP design’s.....	93

4.14	Keeping the images of people identifiable in Cynthia’s DTP design.....	95
4.15	Veronica’s DTP design showing how to blend images of people and landscapes while keeping all images identifiable.....	96
4.16	One of the Prototypes shown to Barb during DTP evaluation.....	97
4.17	Marjory’s original image and DTP Prototype that focuses on one main image..	100
4.18	Left: Barb’s 4th-ranked DTP design; Right: Final DTP design.....	102
4.19	Left: Natalie’s Final Prototype that she connects with most emotionally; Right: 3rd ranked Origami prototype that she felt she would be more inclined to wear because of its easy integration into her wardrobe.....	103
4.20	Chelsea’s Final DTP Prototype Scarf Design.....	104
4.21	Debra’s Final DTP Scarf Design.....	105
4.22	Barb’s Final DTP Scarf Design.....	106
4.23	Natalie’s Final DTP Prototype and Emotions Associated in the Reflection Stage of Evaluation.....	111
4.24	Veronica’s Final DTP and The Values and Emotions it Represents.....	112
4.25	Michelle’s DTP and The Values and Emotions it Represents.....	113
4.26	Margery’s DTP and the values it represents for her.....	114
4.27	Cynthia’s DTP and the closure it provided her.....	116
4.28	Chelsea’s DTP and how it represents closure for her.....	117
4.29	Natalie’s DTP and how it represents closure for her.....	118
4.30	Veronica’s DTP and how it represents closure for her.....	119
4.31	Diagram of key findings as they relate to DTP, theories (EDT and PPSS), and UCD process.....	123

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ABSTRACT

The aim of this study was to explore how a designer's use of digital printing technology and the employment of individualized imagery in textile print design evoke emotional responses to textile print design. Roughly about 13% of women will develop invasive breast cancer over the course of their lifetime (Breastcancer.org, 2022). There is currently little opportunity for breast cancer survivors to express themselves through customized products that meet their criteria. This study sought to address eight breast cancer survivors' identity expression needs using DTP, integrating their personal photographs to co-design a custom DTP scarf. In this study it was found that there was complex negotiation between the public and private self as participants determined what they were willing to share through their photograph selections. It was also found that the custom scarf and co-design process allowed participants to commemorate and find closure regarding their breast cancer journey. The study's findings have contributions to the Emotional Design Theory, and Public, Private, Secret Self model, and User-center design process. Implications for designers, healthcare professionals, educators, and survivors looking to know more about how to create customized apparel that allows for greater identity expression.

## CHAPTER I: INTRODUCTION

Chapter 1 contains the following sections: (a) background of the study, (b) purpose of the study, (c) significance of the study, (d) definition of key terms, and (e) organization of study.

### **Background of the Study**

Breast cancer is the most commonly diagnosed cancer among American women (Breastcancer.org, 2022) and is one of the most recognizable cancers around the world. Currently, there are more than 3.8 million women with a history of breast cancer in the U.S., this includes women currently being treated and women who have finished treatment (Breastcancer.org, 2022). And about 1 in 8 U.S. women (roughly 13%) will develop invasive breast cancer over the course of her lifetime (Breastcancer.org, 2022). This disease has impacted millions of women and their families. Several physical and psychological changes can occur as a result of being diagnosed with breast cancer. The diagnosis of cancer in patients has been linked to an increase in anxiety and depression (Wood et al., 2011). Depending on the form of treatment, it can result in significant body modifications such as the removal of a breast through a mastectomy or possible distortion of breast shape through a lumpectomy (Mayo Foundation for Medical Education and Research (MFMER), 2020). Further, life altering experiences like breast cancer can influence what is valued and shared with others. Leaving some breast cancer survivors to look for ways to disguise these body modifications and or finding new ways to liberate their mode of self-expression.

For some breast cancer survivors, it is important to advocate for more awareness. To do this most women will wear branded apparel that is identifiably related to breast

cancer research. Foundations like The National Breast Cancer Foundation (NBCF) and Breast Cancer Research Foundation (BCRF) are synonymous with its “Go Pink” campaign using the pink ribbon on various soft and hard good products to raise awareness and money for breast cancer research. It is this use of symbolism that has captured the attention of people around the world. Most organizations and other stakeholders may not consider the highly sensitive nature of expressing such a private part of yourself to the public. Breast cancer related apparel is often treated like any other apparel commodity which focuses heavily on brand marketing. There is very little opportunity for breast cancer survivors to have agency over how they would like to express themselves. Most breast cancer custom apparel uses graphics with the iconic ribbon or other related symbolic quotes on a t-shirt and or other apparel related accessories. Within my google searches the researcher could not find any companies who engaged with breast cancer survivors to create custom apparel products that allowed them to uniquely express their breast cancer experience through apparel.

This study seeks to start the conversation of how we can begin to engage breast cancer survivors in the design process to create apparel that meets their needs of identity expression. In the field of Apparel Design, clothing is regarded as a tool for identity and self-expression (Roach-Higgins & Eicher, 1992). The clothes we wear can convey messages regarding social experiences like breast cancer. How one chooses to express themselves through dress can provide a source of psychological comfort that can influence our mood (Norman, 2004).

Imagery is one way we express such identities, whether unaltered or through its manipulated state, it causes individuals to construct meaning (Fox, 1994). Digital textile

printing (DTP) has been used in the apparel industry since the late 1980s. DTP is unique in the fact that it can allow breast cancer survivors to express their identity with personalized photographs/image within textile print design. When creating textile print designs, a designer may customize designs by using photographic imagery and other design elements and principles (i.e., color, line, shape, form, value, space, and texture) to elicit emotional responses (Kimball, 2013). This can also be interpreted to be true for creating DTPs for breast cancer survivors. When using visual imagery in DTP, it can far exceed the expectation of the designers' intended use because the emotional impact lies within the receiver of the imagery (Norman & Ortony, 2003). We often record our lives through imagery and pick and choose what we share with others. We use imagery to make sense of the world around us. Images can help us to better express our thoughts and feelings when words fail (Roach-Higgins, & Eicher, 1992). Using visual imagery in DTP allows the wearer to be their architect of the messages and meanings they convey in the construction of their identity through dress. Therefore, the general aim of this study is to explore how a designer's use of digital printing technology and the employment of individualized imagery in DTP evokes emotional responses to DTP. In doing so, we can gain additional insight into the complexity of our social experiences that contributes to the attractiveness, value, and meanings placed on textile print designs.

Most recently, there is a focus on product customization and the technology that can be used to tailor products for consumer consumption (Scarano, 2018). Retailers are focused on developing product designs that meet their consumer's individual aesthetic and functional preferences (Townsend et al., 2013). DTP is one technology used to create customized products in the apparel industry. This can also be applicable to the

customized needs of breast cancer survivors. Within the textile domain, some researchers have engaged patients with dementia, exploring ways textiles can impact their mental health through active sensory engagement (Treadaway et al., 2015). The design process can be therapeutic in a variety of ways, whether it is the act of creating or the sensory experiences obtained through sight, touch, sound, and smell of textiles and patterns worn.

DTP can act as a vessel in giving breast cancer survivors a creative outlet for self-expression through a co-creation process while enhancing quality of life (Wood et al., 2011). Additionally, having breast cancer survivors co-create a textile pattern design enables them to express their emotions, identity, and the value placed on their creation. Using a co-creation method has been shown to create more innovative products with higher performance outcomes; users also help to bring new ideas and disrupt the normal discourse in the design process (Van den Broeke & Pappas, 2021). From a business perspective, co-creation outcomes positively affect the financial performance of a company and forge stronger community connections. Breast cancer survivors can offer unique insight into the role dress plays in their identity by understanding the elements/factors they draw upon for evaluating textile print design choices and the impact their participation in the design process has on their perception of value of DTP.

According to Donald Norman, who developed the Emotional Design Theory (EDT), emotions play a significant role in the perception of product attractiveness and usefulness to consumers (Norman, 2004). Through the three levels of EDT including *Visceral*, *Behavioral*, and *Reflective*, we can gain greater insights into how breast cancer survivors evaluate DTP choices. The *Visceral* stage can assess the automatic responses of breast cancer survivors towards DTP designs, these are innate senses we are born with

that determine whether we like or do not like something. The *Behavioral* stage provides insight into how breast cancer survivors use DTP, whether they are able to understand it, their predictions of how to use it, and how it makes them feel. The *Reflective* stage is the most conscious the other two levels are subconscious; it helps to provide insight into how breast cancer survivors reflect on their self-image through DTP evaluation. The reflective stage causes us to think back on the memories made and whether we like or do not like it (Norman & Ortony, 2003). This theoretical framework can provide a method for exploring how breast cancer survivors' emotional response impacts their evaluation of textile print designs. Much research has been explored about the aesthetic attributes that cause a product to be more appealing to consumers (Chen & Lapolla, 2020; Orzada & Kallal, 2019; Hwang et al., 2016; Sohn & Bye, 2014). However, little research has been conducted to explore the power emotions play in DTP self-identity expression, and DTP evaluation.

Additionally, we can gain a greater understanding about how breast cancer survivors express their identity in DTP through Eicher and Miller's Public, Private and Secret Self (PPSS) model (1994). Which explores how individuals use dress to express the different levels of self. This directly supports what is happening during the reflective stage in EDT. The PPSS model is based on dress categories related to (i.e., social situation (reality, fun/leisure, fantasy) and level of self-expression (public, private, secret). This model can provide a method for exploring how breast cancer survivors with the use of personalized imagery express their identity through DTP.

It is important to consider the role emotions play in how breast cancer survivors choose to express their identity through DTP, by exploring the factors they consider when

evaluating DTP choices. Through the literature review in Chapter II, we will explore how identities are formed, the role emotions play in decision making, and the unique qualities digital textile printing has to offer while looking at how a co-creation method can contribute to the collaboration experience.

### **Purpose of the Study**

The purpose of this study is to gain an in-depth and holistic understanding of, (a) the role DTP play in female breast cancer survivors' identity expression; and (b) what elements and factors breast cancer survivors' draw upon for evaluating textile print design choices. To achieve the objectives of this study, a qualitative approach was used to address the research problems and unknown variables (Creswell, 2019). In this study, the UCD process was used to allow the researcher to explore deeper nuances about the human experience and the role emotions play in product design, led to interesting insights and discoveries (Norman, 2004). Additionally, to achieve these objectives, Norman's EDT and Eicher and Miller's PPSS model is used to support the study and will be further discussed in detail in Chapter II.

### **Significance of the Study**

The number of women impacted by breast cancer is significant and will only continue to grow due to environmental and genetic factors. The technologies in the apparel field also continue to grow and get more advance allowing researchers and designers to explore new ways to meet the needs of people like breast cancer survivors. The interest in product customization and finding new ways to use tools like digital technologies is expanding. DTP capabilities allow designers and researchers to explore how emotions contribute to our understanding of identity expression and DTP evaluation.

Many designers create textile print products for mass consumption and may or may not consider how the user evaluates their designs. By using DTP technology and use of personalized imagery it can allow the designer to create stronger personal connections for the wearer to the textile print design. These connections elicit strong emotions for the wearer and in turn generate stronger product attachment. Exploring how female breast cancer survivors express their identity through DTP and examining what factors they use to evaluate DTP design choices, could open doors for other designers and researcher to expand on this new knowledge when using DTP to design for underserved markets.

This study's findings are expected to demonstrate how breast cancer survivors' experiences and emotions impact forms of expression through DTP and their evaluation of DTP. In addition, the study's findings are expected to show how the EDT and PPSS model can help explain the central phenomenon and research questions related to breast cancer survivors' identity expression through DTP and factors they draw upon when evaluation DTP choices. The rich insights to be gained through thick descriptions and explanations could help designers, apparel researchers, healthcare and breast cancer organizations, educators, and the survivors themselves.

This study's findings can offer both designers, educators, and researchers a broader understanding about how to engage people like breast cancer survivors in UCD processes. Demonstrating deeper nuances about the human experience and the role emotions play in product design. By exploring how breast cancers survivors (BCS) express their identity through DTP, it can provide healthcare and related breast cancer organization insights into BCS's willingness to share their private self with the public and how they prefer to express their group membership. And for the survivors themselves

these findings are expected to provide insight into how they can express their values through DTP using a UCD approach.

Overall, it is expected that the findings in this study can open an array of new research opportunities, including using DTP as a form of Art therapy; exploring breast cancer survivors group membership through apparel; how other breast cancer related apparel impact's identity expression; exploring how other forms of visual imagery influence what is worn on the body; and exploring and comparing various co-design methods.

### **Definition of Key Terms**

Below are the definitions of key terms that are used throughout the study (as seen in Table 1).

**Table 1.**

#### *Definitions of Key Terms*

Key Term	Definition
<b>Emotional Design Theory (EDT)</b>	EDT suggest emotions play a significant role in the perception of product attractiveness and usefulness to consumers (Norman, 2004)
<b>Visceral</b>	Visceral response is the evaluation of the perceptual properties and classification of objects and how it makes the user feel (Norman & Ortony, 2003)
<b>Behavioral</b>	Behavioral response is the predictions and expectations of the near future and when a product design fails these expectations can evoke an emotional response to the product design (Norman & Ortony, 2003, p.4)
<b>Reflective</b>	The reflective level is conscious and provides understanding, monitoring, and self-examination of one's actions and perceptual self-image (Norman & Ortony, 2003, p.4)
<b>Emotions</b>	Emotions are defined as “a complex chain of loosely connected events that begin with a stimulus and include feelings, psychological changes, an impulse to action and specific, goal-directed behavior” (Plutchik, 2001, p. 345-346)

<b>Public, Private, and Secret Self Model</b>	Public, Private and Secret Self (PPSS) model, categorizes dress based on social situation (reality, fun/leisure, fantasy) and the level of self-expression (public, private, secret) (Eicher & Miller, 1994)
<b>Public Self</b>	Public self is that which is available for others to see (Reilly & Miller-Spillman, 2016)
<b>Private Self</b>	Private self is that which is presented to friends, family, or other intimate relationships (Reilly & Miller-Spillman, 2016)
<b>Secret Self</b>	Secret self is that which is hidden from others (Reilly & Miller-Spillman, 2016)
<b>User-Centered Design</b>	This means the researcher lead, guided, and provided scaffolds and clean slates for the designs to encourage users at all levels of creativity and ability (Sanders & Stappers, 2008)
<b>Co-design</b>	Co-design is defined as the creativity of designers and people not trained in design working together in the design development process (Sanders & Stappers, 2008)
<b>Digital Textile Print</b>	For purposes of this study, the researcher defined digital textile print as print designs that integrate photographs, text, shapes, scanned objects, and textile design theories, processes, and digital technologies
<b>Dress</b>	Dress is defined as an assemblage of modifications of the body and/ or supplements to the body (Roach-Higgins & Eicher, 1992, p.1)

### **Organization of the Study**

This dissertation is organized into five chapters. Chapter I presents the studies background, purpose, and significance. Chapter II presents relevant theories and literature, including EDT, PPSS model, and user-centered design process as it relates to co-creation. Chapter II ends by discussing gaps in the literature and research questions. Chapter III discusses the qualitative research approach to this study, the data collection and analysis methods, the solo coding and trustworthiness of the study, first and second round coding process and codebook, and lastly the key data analysis goals for each study phase. Chapter IV presents the research results and major themes. Finally, Chapter V provides an overview of the study, summarizes the results, discusses practical and

theoretical implications, research limitations and future research directions, and lastly discusses the researcher's own reflection of the study.

## CHAPTER II: LITERATURE REVIEW

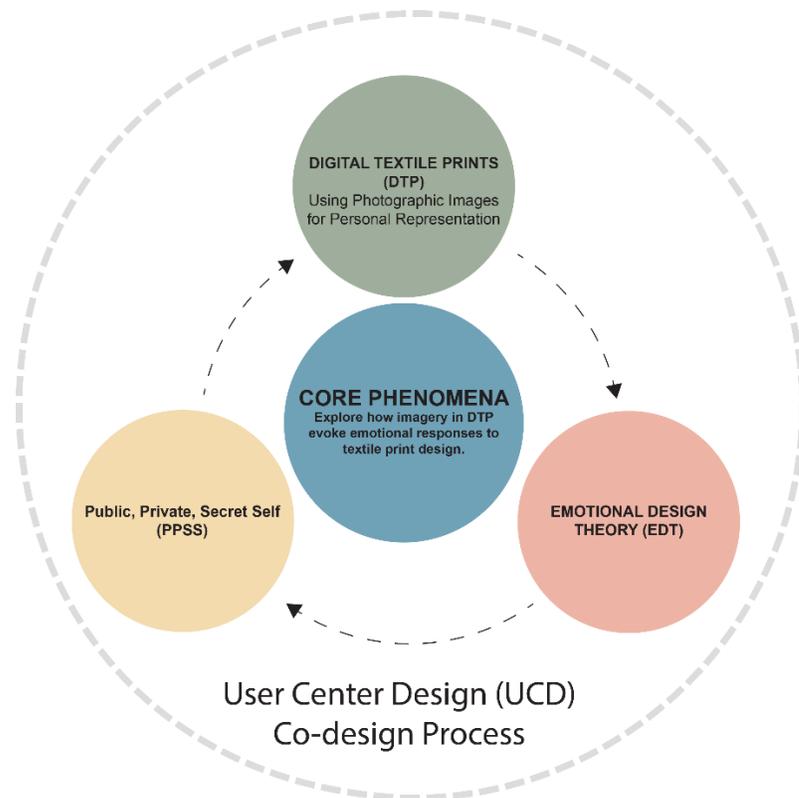
Chapter 2 contains the following sections: (a) theoretical frameworks, (b) interaction between product and user, (c) product experience, (d) identity through dress, (e) gaps in the literature and research questions. These are followed by a summary of the literature and the study's research questions.

### **Theoretical Frameworks**

This qualitative study seeks to explore the phenomenon of how the designer's use of personalized photographs in digital textile prints (DTP) impacts female breast cancer survivor's emotions relating to their identity expression and evaluation of DTP. Much of the DTP research in the apparel field has been done around the methods and design practices of creating digital textile prints, while little research has been done on exploring the central phenomenon in this study. An inductive approach is used to inform how I achieved my research objectives and questions. The qualitative methods used provides additional insights into understanding the central phenomenon. The Emotional Design Theory (Norman, 2004), Public, Private, Secret Self (PPSS) model (Eicher & Miller, 1994), and User-Centered Design (UCD) (Sanders & Stappers, 2008) processes were used to support and guide this research throughout the design of the research study; more specifically, it was used to guide the research questions, data collection, and analysis of findings as seen in (Figure 2.1). The EDT, PPSS, and UCD helped to support key research findings that emerged during data collection and analysis.

**Figure 2.1**

*Diagram of how the central phenomena is supported by DTP, EDT, PPSS, and UCD*



### ***Public, Private, and Secret Self (PPSS) Model***

Eicher and Miller's Public, Private and Secret Self (PPSS) model, categorizes dress based on social situation (reality, fun/leisure, fantasy) and the level of self-expression (public, private, secret) (as seen in Table 2) (Eicher & Miller, 1994).

According to Reilly and Miller-Spillman (2016) *Public self* is that which is available for others to see, whereas *Private self* is that which is presented to friends, family, or other intimate relationships, and lastly *Secret self* is that which is hidden from others (Reilly & Miller-Spillman, 2016). The PPSS model explores how individuals use dress to express the different levels of the self. Furthermore, the PPSS model helps to provide additional insight into EDT's reflective stage of evaluation during self-examination.

**Table 2.***Dress as it Relates to the Public, Private, And Secret Self Model*

	<b>Reality Dress</b>	<b>Fun/Leisure Dress</b>	<b>Fantasy Dress</b>
<b>Public self</b>	Gender Uniforms Business wear (1)	Office parties Dating Sports (2)	Halloween Living History Festivals (3)
<b>Private self</b>	Housework Gardening Novelty Items (4)	Home Exercise (5)	Childhood memories Sensual Lingerie (6)
<b>Secret self</b>	Tights Underwear (7)	Some tattoos Novelty underwear (8)	Sexual fantasies Assume another persona (9)

The PPSS model can be used to explore how breast cancer survivors express their identity through DTP design. Public self is rooted in reality, this the universal part of self-presented through dress. The second is private self which is an intimate part of self-presented in dress and demeanor to significant others, and lastly secret self may or may not be shared with others and uses dress to engage in fantasy. When revisiting the PPSS model Eicher further suggested two additional considerations need to be made. First, it is suggested that purpose for selection be considered when evaluating the category and level of dress (Eicher et al., 1994). Secondly, Eicher says the context of the situation for which the person is dressed is as equally important (Eicher et al., 1994).

The PPSS model serves as way to better understand the levels of and categories of expression as it relates to DTP. While also considering breast cancer survivors purpose

for selection and context when wearing their DTP scarf. However, as suggested by Norman emotions play a significant role in these kinds of decisions (Norman, 2004).

### ***Design and Emotion***

Emotions are a part of everyday life and how we experience the world around us (Norman, 2004). Emotions are defined as “a complex chain of loosely connected events that begin with a stimulus and include feelings, psychological changes, an impulse to action and specific, goal-directed behavior” (Plutchik, 2001, p. 345-346). The internalization of conscious and subconscious emotions is complex, and humans often experience several emotions at once (Plutchik, 2001).

Emotions in response to design can be derived from both the designer in the creative process and user reaction. Many users display an instinctual reaction to the product design (Norman & Ortony, 2003). These reactions can be changes in heart rate, muscle tension, perspiration, breathing, facial expression, and neural brain activity can be affected during the emotional response to design (Healey, 2014).

Designers have the ability to elicit a broad range of positive and negative emotion through design (Norman & Ortony, 2003). Evoking emotions in a product design can be either intentional or unintentional on the designer’s part; the utility and appearance of a product design are key features in understanding user reactions (Norman & Ortony, 2003). Designers may purposefully develop products that evoke emotions in users to receive their desired outcomes. Some designers induce emotions indirectly through the symbolic meaning of products and appearances (Norman & Ortony, 2003). While other designers rely on their intuition or perception of how their design will be received and reacted to by users (Norman & Ortony, 2003). Norman suggests that emotional response

is more likely to occur by accident when a designer focuses on utility versus when designers focus on product appearance (Norman & Ortony, 2003). Designers who create novel designs can increase product attraction and emotional response (Seifert & Chattaraman, 2017).

Designer intention and viewer perception can offer distinctly different views of a design. User interaction with utilitarian features of a design can cause an emotional response to occur, which can be different than the designer's intentions (Norman and Ortony, 2003). Emotions can arise when a design fails to meet or exceed expectation norms (Norman and Ortony, 2003).

### ***Emotional Design Theory (EDT)***

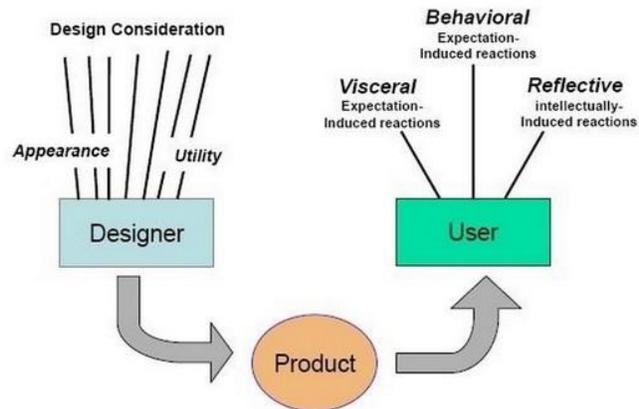
EDT, established by Don Norman in 2004, was developed to explain how emotions play a significant role in the perception of product attractiveness and usefulness to consumers (Figure 1). EDT states there are three interconnected levels of design that influence our emotional experiences with products, like digital textile print design (DTP). The three levels are *Visceral*, *Behavioral*, and *Reflective*. Each is suggested to play a critical role in the functioning process of an individual (Norman, 2004). According to EDT, the visceral level is associated with ingrained and automatic qualities of human emotion. For example, in DTP, attraction to aesthetics, like color, can be a visceral-level emotion stemming from the design. The second level, behavioral, refers to the “controlled aspects of human action” (Komninos, 2020, para. 1), where people unconsciously analyze a situation and develop goal-directed strategies most likely to achieve their goal. This is where we think about how a product is used, how we learned to understand it (or if we understand it), predictions of what is going to happen, and the

resulting emotions. The behavioral level, when looking at DTP can be associated with the effectiveness and wearability predictions of the product.

Finally, the reflective level is conscious thought and reflection associated with learning new concepts and generalizations about the world. The reflective level allows us to think about our experiences and determine if we liked it or not. In DTP, this can be seen through the values represented in the DTP design like prestige/status, much like a luxury designer Louis Vuitton bag there can be an element of exclusivity. The reflective level monitors, reflects upon, and attempts to bias the behavioral level (Norman, 2004, p.22). People can assign numerous types of value to DTP; it is this value that impacts the importance placed on the design and the resulting emotions derived from its use. If a textile print is made up of images important to the wearer that represent a memory or symbolize something for the wearer, it may result in specific emotional reactions and cause the value of the product to increase. Our most favorite objects that we have are ones that have a story or that we have an emotional attachment to. Design is all about creating products that meet users' needs; this may be functional, symbolic, or emotional needs. However, the designer's views and user's views vary as seen in (Figure 2.2). These three levels are interconnected. For example, the behavioral level can be affected by the reflective level and effect the visceral level (Norman, 2004).

**Figure 2.2**

*Emotional Design Theory where the designer's view of the product differs from the User's view*



EDT can further our understanding of how emotions arise in response to product design and provide a framework for exploring how DTP impacts the emotional response of breast cancer survivors when evaluating DTP design choices. This theory takes into account how the *Visceral*, *Behavioral*, and *Reflective* levels of human emotions impact the response to a design. These levels are influenced by the interaction of each other and expand our knowledge about the interrelated connectedness of emotional responses to design. The discussion that follows, further defines each of the three levels of emotional design, particularly as they relate to the goals of this dissertation study.

**Visceral Design.** As noted above the visceral response to design relates to the appearance of an object. These responses happen subconsciously and are automatic, we are born with senses of whether we like or do not like something (Norman & Ortony, 2003). The visceral level is suggested to be triggered by the brain through experience. Visceral response is the evaluation of the perceptual properties and classification of objects (Norman & Ortony, 2003). Classifications are made to determine if an object is

good or bad (Norman & Ortony, 2003). There can be both positive and negative reactions to features like rounded and smooth objects, symmetrical objects, color, texture, and sound in our environment (Norman, 2004). These reactions are biological and focus on the current state of the perceived features of an object and can be generalizable across cultures (Norman and Ortony, 2003). Designers addressing the visceral level of appearance can cause behavioral level responses (discussed below) from users to the product design (Norman & Ortony, 2003). People are often initially drawn to DTP designs due to their aesthetic appearance in regard to its texture, color, shape, or design. One of the research study goals is to explore what factors/elements do breast cancer survivors draw upon for evaluating DTP design choices? Which can help to understand how these choices impact breast cancer survivors' values in DTP. By examining the visceral response additional insights into the interconnectivity between the visceral, behavioral, and reflective levels can be gained.

**Behavioral Design.** As opposed to the visceral level, behavioral responses are learned. Like the visceral level, behavioral responses are subconsciously processed and automatic in response (Norman & Ortony, 2003, p.4). Behavioral response is the predictions and expectations of the near future and when a product design fails these expectations can evoke an emotional response to the product design (Norman & Ortony, 2003, p.4). Because the behavioral level is learned it can have cultural variance (Norman & Ortony, 2003, p.4). Although, for the purpose of this study this is not relevant as all participants are native to the U.S. Utility and functionality of a product is inherent, and many people have predictions or expectation of a products performance. The behavioral level examines the expectations and emotional reactions people have regarding product

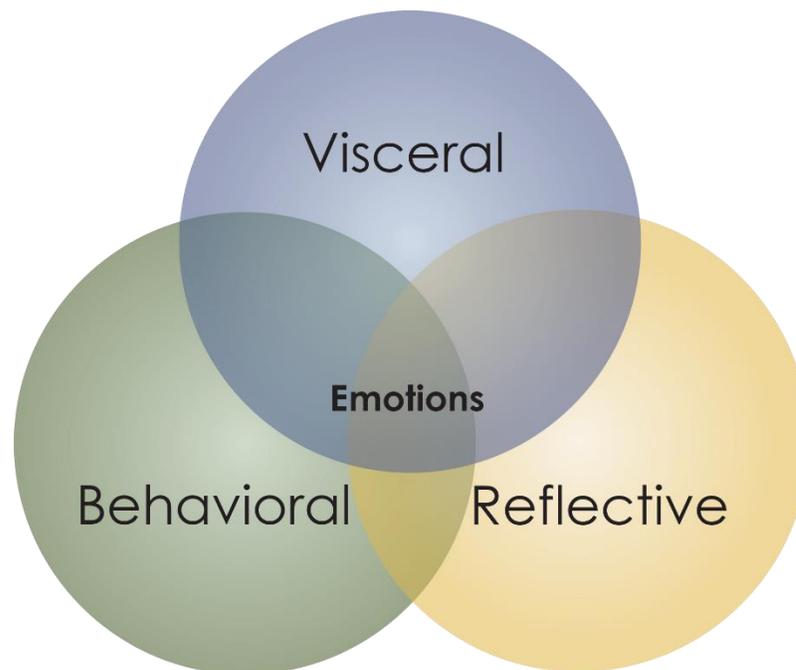
performance. The same can be said when evaluating DTP design choices, if a textile print design exceeds your expectation you will be inclined to have a positive reaction to the DTP. Whereas if a DTP fails your predictions or expectations of performance, it will have a negative emotional reaction. Product designs should meet the appearance, functional, and emotional needs of the user. These needs can vary and sometimes we need a product to function, and we do not care about its appearance. There may be instances we are driven to buy a product because it is attractive, or it fulfills other emotional needs, and we are willing to forgive its functionality. Textiles can offer functional value like personal protection, physical comfort such as ease of movement, thermal comfort, fit, etc. (Rosenblad-Wallin, 1985). Furthermore, textiles may also provide value like group membership, decoration, fashion, respectability, etc. (Rosenblad-Wallin, 1985). Value is further evaluated in the reflective level. Additionally, textiles contribute to the emotional needs of the user such as self-esteem, state of mind, psychological comfort, happiness, etc. User interactions with a product is important and contributes to the user's understanding of the product's functional performance. Equally important, is developing a DTP that meets the user's values, this can contribute to the emotional reaction a user has to the product. The use of digital print technology allows users to customize textile prints with imagery that has greater value to them. This in turn can impact perceived product attractiveness, use, personal connection, and emotional responses to the design. Both the visceral, behavioral, and reflective level of this theory can help gain insights into how emotions play a role into the response or expectations of DTP performance.

**Reflective Design.** The reflective level of design and responses represents “the maximum processing level of reflection” (Norman, 2003 & Ortony, p.4). The reflective level is conscious and provides understanding, monitoring, and self-examination of one’s actions and perceptual self-image (Norman & Ortony, 2003, p.4). Within the reflective level people are able to display emotions such as pride, shame, disgust, and gratitude (Norman & Ortony, 2003, p. 4). These feelings are derived from the visceral and behavioral levels (Norman, 2003, p. 4). Although, the reflective level is significantly influenced by experience, culture, social groups, and age (Norman & Ortony, 2003, p. 5). One’s social role can also cause the reflective level to change (Norman & Ortony, 2003, p.5). For example, images used in DTP can cause breast cancer survivors to reflect on memories made and induce an emotional response by the user (Norman & Ortony, 2003). Reflective level responses typically overcome the visceral level of emotions (Norman & Ortony, 2003). This can be seen through brands and organizations like breast cancer awareness who use textile print designs to promote prestige, or group membership. For example, the Go Pink campaign uses its recognizable pink ribbon in textile print designs to place on various products. You may not be viscerally attracted to the pink ribbon print design. However, your behavioral interaction with the product on top of your reflection of what it means to own such a product with the pink ribbon print design can influence your emotional response to owning and wearing such a textile print design. The reflective level plays a significant role in our evaluation process and can impact the visceral and behavioral levels of response. This is where the user reflects and evaluates on their self-image and experiences with the product design like DTP to determine their feelings. The Venn diagram below (Figure 2.3) demonstrates how the visceral, behavioral, and

reflective levels are interconnected with emotions acting as the connective link between all three levels. This study will ask questions that focus on the user's emotions and value placed on the product design.

**Figure 2.3**

*Venn EDT diagram demonstrating how the visceral, behavioral, and reflective levels are interconnected*



***Limitations of EDT***

A limitation surrounding Norman's EDT theory is explored in a research study titled "Do Attractive Things Work Better"? An Exploration of Search Tool Visualizations (Chawda et al., 2005). Chawda et al. aimed to explore associations that exist between user perceptions of aesthetics and usability regarding Human-Computer Interaction (HCI); and to validate Norman's theory that appearance of objects effect usability (Chawda et al., 2005). Although this study challenges Norman's assertions regarding appearance it also supports Norman's work that visceral appearance can lead an affective

emotional response. This validates that appearance properties of a design having an impact over perceived value.

### ***Application of EDT***

A variety of disciplines have applied EDT to explore usability and aesthetic impacts on emotional responses. Disciplines such as human-computer interaction, healthcare, mobile technology, education, and product design have contributed to our understanding of how emotions impact user response (Desmet et al., 2001; Kim, 2020; Lopatovska, 2010; Mao, 2017; Plass, 2013;). Regardless of the discipline, each recognizes the important role emotions play in eliciting positive responses in user interaction.

### ***User Involvement and EDT***

In the literature, there is significantly fewer examples of the application of EDT in the field of fashion research, although there is a growing understanding of the role emotions play in user interaction with apparel related products (Sanchez, 2015; Stead, 2004). The discussion that follows is a review of literature in the field of fashion that looks at the role emotions play related to interactions between the product and user (Sanchez et al., 2015), smart clothing design (Stead et al., 2004), cultural heritage (Ceballos, Min, 2020; Hou, 2020), consumption practices (Neto & Ferreira, 2020), self-identity and product attachment (Ceballos & Min, 2020; Orth et al., 2018; Allen, 2002), and product experiences (Crilly, Moultrie, & Clarkson, 2004; Desmet & Hekkert 2007; Hekkert, 2006). Although these studies do not use EDT as their theoretical framework, much can be learned about the role emotions play in user interaction and some of the factors that contribute to emotions from exploring this body of work.

## **Interaction Between Product and User**

Researchers have used EDT to explore the requirements of interaction between the apparel product and user. Researchers Sanches, Ortuño, and Martins (2015) found that criteria used for examining clothing included physical adaption, individual expression, and social representation, more specifically looking at clothes' exchange with the body and the relationship with the physical and cultural environment (Sanches, Ortuño, & Martins, 2015). This study found usability parameters (mobility, thermal and tactile comfort, handling facility, and practicality) are closely linked to those of pleasure (attractiveness, versatility, personal and social identification, symbolism). The findings indicate that the sensorial experiences play an important role in the exchange of cognitive experiences, personal self, and collective universe (Sanches et al., 2015). Furthermore, aesthetic, and symbolic aspects can be associated with pleasure that can impact its use and attached meanings for the wearer (Sanches et al., 2015). This study also found that adoption of clothing functionality (security of materials and accessories, weight and resistance of materials, maintenance, and personal protection) is impacted by its use in the environment and acceptance within the socio-cultural context (Sanches et al., 2015). It is recommended that designers consider the wearer's physical, psychological, and social levels, including both the private and public space when designing clothing.

## ***Consumption Practices***

Emotions not only play a critical role in expressing ourselves through apparel, but they also contribute to our consumption practices. The ecological footprint clothes have is growing and contributed to 11.3 million tons of Municipal solid waste Municipal solid waste (MSW) textile waste in 2018, making it 7.7 percent of the total MSW landfill

waste (EPA, 2020). This has led to designers looking for ways to engage the wearer in long-term commitments with the clothes they wear in order to reduce textile waste. One-way researchers have explored increasing the product life cycle is through product attachment. While other researchers have explored the relationship between wearers and their clothes (Neto & Ferreira, 2020). The relationships people have with clothes is complex and possess more emotions than some may think. Research has found much like the emotions in the relationship we have with people can be found in our relationship with clothes (Neto & Ferreira, 2020). A study by Neto and Ferreira suggests that instead of designers focusing on the item's attributes that attract a wearer that they should focus on the objects use and the relationship that exist between the wearer and the item, which could lead to prevention of the relationship deteriorating and ending (Neto & Ferreira, 2020). As a result, knowing the user's needs with their relationship with the item can lead to more sustainable patterns of consumption (Neto & Ferreira, 2020). Digital textile print design can be used as tool to explore the deep and complex relationships we have with an item, focusing on how these relationships and connections are built. More understanding is needed about how imagery may impact the wearers relationship with the item.

### ***Self-identity and Product Attachment***

Our relationships with objects allow us to express and communicate beliefs, experiences, memories, people, places, and values (Orth et al., 2018). It is these associations that provide the wearer the opportunity to develop a sense of self-identity. The associations assigned to objects can come from the history of ownership, use, and perceptions of attributes such as form, color, texture, size, and smell or the beliefs of who might own or use the object (Allen, 2002).

Orth, et al. (2018) used the product attachment theory to explore how products can be designed based on participants' life stories. Product attachment has been found to be linked to three dimensions including product experience; aesthetic properties; positive emotions; and the symbolic and instrumental meanings associated with the product (Ceballos & Min, 2020). Researchers have found that the stronger the experience of meaning with a product the stronger the attachment towards the product (Ceballos, Min, 2020). Orth, et al. (2018) sought to "understand how design can support user engagement in the process of meaning making and identity construction through their relationship with products" (Orth et al., 2018, p.100). The researchers express the importance of the authentic associations formed between an object and the user, finding that design can impact the emotional value and self-identity of the user (Orth et al., 2018). Researchers found two conditions needed in order to design objects with meaningful associations. The first being cueing meaning, which refers to the importance the specific aspect has on their identity (Orth et al., 2018). They found that an object must cue meaningful aspects of their identity to be considered meaningful to the user (Orth et al., 2018).

What an individual considers to be important to their self-identity continually evolves as they experience the world around them and their sense of self continues to develop (Kleine et al., 1995). Additionally, they found that cueing memories of specific experiences and events were more meaningful than reflecting on a general time period, value, or belief (Orth et al., 2018, p. 101-102). The second condition is authentic embodiment, which refers to the meaningful associations required by the user to perceive the associations as authentically embodying the associated source. These findings also

suggest that authentic embodiment can be created by channeling into the meaningful imagery that exist in the minds of the user, in order to create associations that are authentic (Orth et al., 2018). The researchers recommend that designers consider the user's pre-constructed understandings of the object's features, attributes, product experience, and beliefs of the kind of person who would use or own such an object (Orth et al., 2018). Much like this study that used imagery captured through the participants shared stories, it can be inferred that images used in textile print design can be used similarly to express the beliefs, experiences, memories, people, places, and values that contribute to self-identity. The use of images in textile print design could help breast cancer survivors to express their identity and increase the emotional value of the object.

### **Product Experience**

Desmet and Hekkert have made considerable contributions to what we know about product experience. Following Hekkert (2006), Desmet and Hekkert provide three dimensions of product experience being aesthetic pleasure, attribution of meaning, and emotional response (Desmet & Hekkert, 2007). They define product experience as “the entire set of affects that is elicited by the interaction between a user and a product, including the degree to which all our senses are gratified (aesthetic experience), the meanings we attach to the product (experience of meaning) and the feelings and emotions that are elicited (emotional experience)” (Hekkert, 2006, p. 160). They found that experiences influence behavior and behavior influence the experience, this supports the assertions made in EDT that visceral, behavioral, and reflective levels are interconnected (Desmet & Hekkert, 2007). This research supports the EDT framework of what is known about the interaction between the user and the product.

According to Crilly, Moultrie, and Clarkson (2004) cognition plays into the interpretation, memory retrieval, and associations used in our ability to assign value to a product. These cognitive responses are broken up into two categories the “semantic interpretation” and “symbolic association” (Crilly et al., 2004). Researchers agree that cognitive processes are dependent on the individual and cultural differences (Norman, 2004; Crilly et al., 2004; Hou, 2020). It is proposed that in order to have a greater understanding of the affective experience it will require an approach that explains how behavior, cognition, and experience are interrelated in the human product experience (Desmet & Hekkert, 2007). In my study, breast cancer survivors will each contribute unique insights into the interconnective cognitive processes used in the visceral, behavioral, and reflective levels to evaluate textile print designs. This study will also add to our understanding about how emotions contribute to the product experience.

### ***Co-design and User Involvement in Developing Products***

Since emotions lie with the users and the meanings they derive from the product, working with the end user helps in the design process to inform the designer of the user’s reactions (Desmet, Overbeeke, & Tax, 2001). Researchers recognize the challenges in obtaining the desired emotional fit for the user, as each user can have different emotional needs and responses. Additionally, it can be difficult for people to express their emotions and explain why they feel the way they do. However, many researchers agree that design goes beyond the usability (behavioral level) and physical appearance (visceral level). They recognize the meaningful role (reflective level) user interaction plays in establishing long-lasting emotions and product attachment.

Researchers have explored the impact of user involvement in design creation as an approach to art therapy and related visual and tactile elements in design that promote emotional responses and well-being (Lapolla, and Cobb, 2016; and Treadaway, 2016). Sensory stimuli such as vision, hearing, and touch contribute to the creation of artworks, which in turn allow the designer to experience an emotional response during creative processes of ideation (Treadaway, 2011). Visual characteristics such as shape and form can significantly impact digital imagery (Treadaway, 2011). A case study titled “Shorelines: transforming emotion through creativity” explores the impact hand-making has on both physical and mental well-being (Treadaway, 2011). This study examined how visual arts can support digital technology, while the findings also support creative practice’s ability in evoking emotion into artwork (Treadaway, 2011).

The landscape of user-centered research continues to evolve and has made considerable contributions to how researchers and designers interact with the user and approach their design practice. Involving the user in the co-designing process helps the designer to gather specific information needed to create a design suitable for their needs (Sanders & Stappers, 2008). Co-design is defined as the creativity of designers and people not trained in design working together in the design development process (Sanders & Stappers, 2008). These collaborative design practices have brought new ways of exploring collective creativity. Often it is the job of the designer to interpret the information given by the user to deliver a product that meets or exceeds their usability, aesthetic, and value expectations (Rosenblad-Wallin, 1985). Sanders and Stappers (2008) view the role of the researcher (who can be the designer) as the facilitator, helping to

lead, guide, and scaffold the user through their creative expression (Sanders & Stappers, 2008).

### ***The Importance of Pleasure on Emotional Response to Design***

Norman also recognizes the importance that pleasure has on an emotional response to design. In psychology, the word “affect” or “affective state” refers to experiences that involve a perceived goodness or badness, pleasantness, or unpleasantness (Desmet & Hekkert, 2007). The term affect refers to all types of subjective experiences including those that involve evaluation of textile print design. Textile prints are a form of surface design and can impact the affective state of the user’s emotions and arousal. According to Russell (1980, 2003) the emotions and physiological arousal one has from the experience are interrelated to one another (Desmet & Hekkert, 2007). This is demonstrated through the circumplex circular two-dimensional model that Russell calls the “core affect” which combines the affect dimensions with arousal (Russell, 1980). This circular model displays a horizontal axis that represents the valence from pleasant to unpleasant and a vertical axis that represents arousal from calm to excitement. The model illustrates examples of affective responses experienced in the user-product interaction.

This circumplex model can help to explain the emotions involved in the interactions process we have with objects throughout our day. There is a spectrum of variance that can occur in the affective state anywhere from neutral, moderate, or extreme (Desmet & Hekkert, 2007). These changes in affect can be short lived or long lasting and can act as the focus of attention or be in the background of the user’s experience (Desmet & Hekkert, 2007). The ‘core affect’ can cause behavioral changes to occur within the

product interaction (Russell, 1980). These emotions are strongly connected to the visceral, behavioral, and reflective levels of interaction with a product. When looking at the calming colors of blue within a textile print design a pleasant arousal may be activated. This can cause the user to respond with joy or happiness. Although, the visual texture of a cactus in a textile print design can activate unpleasantness and cause the user to experience disgust or irritation as seen in (Figure 2.4). When using images of loved ones in a textile print design it may create a feeling of calm unpleasantness from sadness in remembering those who are a part of our lives. On the other side of the spectrum, using abstract shapes may induce a pleasant excitement and cause the user to have a sense of curiosity about the textile print design. It is these emotions that cause a user to assign value to the design (Norman, 2004). However, product experience can be impacted without relating to a specific stimulus. Moods are typically not elicited by a specific stimulus, but by a combination of internal and external causes (Desmet & Hekkert, 2007). For example, someone may be grumpy because of the rainy and overcast weather, lack of sleep, or a flat tire. Or in some instances, the affect may be elicited due to a specific cause, like when someone makes an offensive comment. The behavior of the offender can cause the person to be grumpy. The same can be said when looking at human product interaction, someone's emotions can come from a combination of causes or one specific cause. For example, when looking at the following textile print design in Figure 2.4 below. The user may find the color unpleasant.

**Figure 2.4**

*Original digital textile print designed by researcher Eckerson (2020)*



Also, human-product interaction can be (or involve) a cause of change in core affect. Interacting with a stimulating computer game can cause the experience of exhilaration, whereas interacting with a slow computer can cause the experience of frustration. In line with these examples, we define product experience as a change in core affect that is attributed to human-product interaction. We use the word “attributed” instead of “caused” because a change in core affect due to a particular cause is sometimes misattributed to another, imagined, cause (Schwarz & Clore, 1983). One can, for example, be disappointed with a colleague for a mistake for which they were not responsible. Or, one can be angry with the television set, because it appears to be broken as it shows a white signal, when in fact one should actually blame oneself for accidentally disconnecting the signal cable. The anger experienced in this situation is considered to be a product experience because it is believed to be caused by, or attributed to, the television.

Many researchers using a user-center design approach have shifted their focus on the affective experience and involvement of the human product interaction. In a study titled “Human factors for pleasure in product use” the researcher explores pleasure and displeasure in product use (Jordan, 1998). This study found feeling of pleasure and displeasure related to product use (Jordan, 1998). Specific product features that were found associated with pleasure and displeasure includes usability, aesthetics, performance, and reliability (Jordan, 1998). The study also found that pleasurable products were used more frequently, which effected purchasing decisions (Jordan, 1998).

The affect theory has allowed researchers like Picard (1997) to explore processes related to affects role in user product communication. Picard explored how a computer can sense, recognize, and respond to the human communication of emotions (Picard, 2000). When expressing emotions, they both have to be sent and received. However, emotion communication can be interpreted differently by different people. One can communicate their emotions through varying forms some may express their emotions through art, music, literature, dress, and other activities. Using visual images within textile print design can offer a creative way to communicate emotions. With these varying forms of self-expression comes different ways to track emotion communication through the interaction process. Users can self-report their emotions through the interaction process, however this does require the user to stop during the process to self-report (Picard, 2000). Another form of tracking emotion is through concurrent expression, which can be captured through video, microphone, typing or mouse pressure, bodily functions, smell (Picard, 2000). Using human-human analogy can enable the person to express their emotions in the task they are doing without interruption, creating a

natural method of tracking (Picard, 2000). This helps to not put pressure on the user to verbally express their emotions that might otherwise be difficult to put into words.

Depending on the tools involved and the user's ability to use those tools in the creative process can lead to its set of emotions that might lead to frustration, confusion, anger, and anxiety. These emotions have a direct impact on the user's productivity, learning, social relationships, and well-being (Klein, Moon, & Picard, 2002). Having the researcher who may act as the designer with skills needed to support the user through the design process can lesson these negative emotions and experiences (Klein et al., 2002). Design software technology requires special skill and knowledge and although a user might like to make a customized print, they may not have the expertise and access to the technology needed to allow them to creatively express themselves in this way. Digital textile prints require such specialized software, knowledge, and skill. Thus, in this study the researcher/designer will employ their expertise in ensuring the participants vision and criteria is met.

### ***Emotions and Color***

Similarities between emotions and colors have been recognized since 1921 with regard to the work of William McDougall (Plutchik, 2001, p. 349). Plutchik argues that analyzing emotions is like patterns used in color theory research (Plutchik, 2001, p. 350). He suggests that like mixing colors we can make judgments about combinations of emotions (Plutchik, 2001, p. 350). Emotions relating to color is referred to as color emotions which are often expressed with semantic words such as, active, warm, cold, etc. (Solli & Lenz, 2011).

We naturally observe color in combination with other colors and many researchers argue that it is inappropriate to apply a single-color scheme to identify the emotion evoked by color images (He et al., 2014). A singular color can possess different meanings based on cultural differences and colors it is combined with; therefore, color combinations are preferred over a single color to evoke specific emotions (He et al., 2014). When looking at photographs there are several factors that can contribute to our emotional response some can be related to context, or objects within the image, and colors that make up the image.

Researchers Wilms and Oberfeld (2018) found that depending on the hue saturated and bright colors were associated with higher arousal. Further, the hue also impacted arousal increasing responses from blue and green, to red (Wilms & Oberfeld, 2018). In addition, they found that arousal was higher for highly saturated colors of blue (Wilms & Oberfeld, 2018). Color and color combinations play a significant role in how we interpret color and the impact it can have on our emotions.

### ***Visual Images and Emotional Messages***

Visual images can provide powerful messages of symbolic meaning and emotional messages through visual communication. A research study entitled “*Emotion Based Classification of Natural Images*” seeks to analyze which specific design features promote emotional response for natural visual imagery (Dellagiacoma et al., 2011). Researchers have used various methods for image analysis such as pattern recognition, affecting computing, artificial intelligence, cognitive science, and psychology (Dellagiacoma et al., 2011, p. 17). This study recognized the important role color and texture play as factors in generating emotions of happiness, sadness, fear, disgust, anger,

and surprise in response to natural visual images (Dellagiacoma et al., 2011, p. 18). It is mentioned that image content has a significant correlation on the emotional response of an image (Dellagiacoma et al., 2011, p. 18). Researchers found links between the specified emotions and characteristic features of color and texture (Dellagiacoma et al., 2011, p. 20). Additional research has explored the important role color and pattern play in emotional response (Shin et al., 2010).

Furthermore, images of natural environments can have a positive impact on well-being and have been found to reduce stress levels (Yaworski, 2015). According to Soderback, Soderstrom, & Schalnder (2004), “Imagining and viewing nature is used in horticultural therapy to induce healing, alleviate stress, increase well-being and promote participation in social life for people with mental or physical illness, (p. 1). Natural images can also be integrated in digital textile print design, allowing for an immersive interactive experience with visual imagery. Exposure to natural images through print design can cause emotions and may lead to positive mental health effects.

Breast Cancer survivors have unique experiences that contribute to their identity expression. Personalized textile print designs allow the user to creatively express themselves. The visual imagery used in digital textile print design can influence the value and meaning placed on an object. Imagery is a powerful tool for eliciting conscious or subconscious emotions. How one evaluates imagery is complex and there can be multiple factors that contribute to someone’s perceived value. Through this research I will explore the connections between image evaluation, emotions, and value specific to breast cancer survivors.

## **Identity Through Dress**

Dress is used as a tool to nonverbally express one's identity that might otherwise be too difficult to express in words (Roach-Higgins, & Eicher, 1992). How one dresses is influenced by several factors such as social interactions with others and by the cultural, social, and gender norms that exist in the world (Kaiser, 2012). When deciding what to wear, one is also negotiating diverse power and class relations in the process (Kaiser, 2012). For example, if you were a chief financial officer in your place of employment you might be more inclined to wear a suit to work, because of the social and cultural expectations of someone in a position of power.

Roach-Higgins and Eicher (1992) provide a holistic, nonbiased, and global definition of dress, which has been a seminal definition of dress in the field of clothing and textile research. According to Roach-Higgins and Eicher "dress is defined as an assemblage of modifications of the body and/ or supplements to the body" (1992, p.1). Modifications of the body can include, but are not limited to modifications of hair, skin, piercings, and scented breath (Roach-Higgins & Eicher, 1992, p.1). Supplements are things that adorn, enclose, wrap, suspend, and or are pre-shaped enclosures from the body such as clothing, jewelry, and or accessories (Roach-Higgins & Eicher, 1992, p.1).

In this study, dress is considered to encompass both body modifications (hair, odor, pricings, tattoos, etc.) and supplements (clothing, accessories, jewelry, etc.) that suspend from the body. More specifically in this study scarves will be used as a form of dress and it will be up to the user to determine how it will be worn. Understanding the meaning of dress is crucial in this research because it provides a broader definition and holistic view of what makes up individual identity. It goes beyond clothing and considers

all five senses i.e., taste, smell, sight, hearing, and touch. Considering the physical properties with that attached meanings of dress is important when evaluating the emotional response and symbolic value dress can have. For example, using visual images in a textile print design that remind us of a place, time, or event can cause feeling of nostalgia, happiness, sadness, etc. Dress like other products requires user interaction and meanings to be derived. Like in EDT these interactions and meanings made contribute to the emotional response of the user between the visceral, behavioral, and reflective levels. According to Desmet, Overbeeke, and Tax they argue that “emotions are not elicited by tangible product attributes but by intangible highly personal construal’s of the product” (2001, p. 1). Similar to EDT emotions do not lie within the dress, but rather the meanings made from the dress by the user.

Although, we use dress to express personal identity the interpretation of the viewer may not hold the same meaning as the wearer. Cultural and social norms will impact the interpretation of dress for both the wearer and viewer. Dress has symbolic meaning and can be used to make assumptions about an individual’s age, wealth, intelligence, gender, social position/power, occupation, religion, marital status, and attitudes and behaviors. The lens in which people interpret dress is through their experience in the world. The meaning of dress is dependent on a particular time and place. We dress ourselves for many different reasons such as protecting the body, religious practice, to provide extension of the body’s abilities, aesthetics, and nonverbal communication about the wearer (Eicher, 2000).

Dress can connect us to individuals or separate us from others. For example, we can use dress to tell stories, demonstrate group membership, religious beliefs or moral

codes of conduct. Dress can be both a product and a process that is unique to human participation. For example, humans can have a role in the product development process of making a product unique to them. Both dress and the process of dressing can have a positive or negative impact on the human experience. For example, if a garment fits too tightly or the fabric is itchy it can negatively impact the wearer. However, if a product like glasses physically helps the wearer it can have a positive effect.

Many items can be involved in one's dress that demonstrate creativity, beliefs, and technology. The process of dressing the body involves addressing the physical and aesthetic needs of the wearer and meets the social and cultural expectations of how an individual should look. The process of dress requires all five senses of sight, touch, sound, smell, and taste. This is one of the unique qualities that dress provides the human experience. It is this level of sensory experience that connects individuals so closely to their dress and identity (Eicher, 2000).

### **Gaps in the Literature and Research Questions**

Overall, no studies within the field of fashion research, have connected the potential for digital textile printing and UCD to elicit emotional responses in apparel products. No studies that use digital textile printing have applied EDT to explore the role that emotions play in user interaction in textile print design. Using digital technology to create textile prints can provide an avenue to explore this gap further. Helping to capture the stories, journey, and memories of breast cancer survivors to empower them to express their identity, while also understanding the role, emotions play in adding value to the textile print design. The findings and principles expressed in EDT research and in other related fields can be applied to the growing understanding of emotions in textile print

design. Based on the review of literature, no researchers have explored EDT in digital textile printing, particularly how visual imagery impacts emotional response, the topic of this dissertation. Further investigation of how digital print imagery in clothing design can impact the visceral, behavioral, and reflective emotions is needed. Given this, the research questions that will guide this study are:

RQ1: What role does digital textile print (DTP) design play in breast cancer survivor's identity expression?

RQ2: What elements/factors do breast cancer survivor's draw upon for evaluating digital textile print design choices?

## CHAPTER III: METHODS

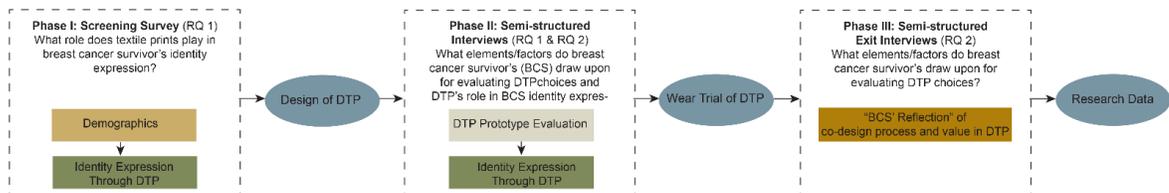
Chapter 3 contains the following sections: (a) Research Approach, (b) Data Collection – Rationale, (c) Recruitment and Participants, (d) Data Collection – Measures, (e) Data Analysis, (f) Solo Coding Trustworthiness, (g) First and Second Round Coding Process and Codebook, (h) Key Data Analysis Goals for each Study Phase.

### Research Approach

Figure 3.1 outlines the research study design applied in this qualitative study for a larger view please see (Appendix A). This study was conducted in three phases: (a) Phase I: Screening survey, demographics, and forms of identity expression, (b) Phase II: Semi-structured interviews with breast cancer survivors exploring identity expression, and digital textile print (DTP) evaluation, (c) Phase III: Semi-structured exit interviews focused on their reflective experience about their identity expression and value of the textile print. Between Phase I and II, the researcher created the customized DTP scarf prototypes. Between Phase II and III the participants wore their customized DPT scarves in wear trials.

**Figure 3.1**

#### *Research Study Design Diagram*



*Note.* This diagram is a representation of the three phases and what is taking place between the phases within the study design.

This study used an exploratory qualitative approach to address the research problems and unknown variables (Creswell, 2019). A key strength of qualitative research is that it allows rich insights to be gained through thick descriptions and explanations (Miles et al., 2014). It also allows deeper insights to be gained regarding social processes of human interactions (Torrance, 2010). Social systems are a direct result of human action and performance of the roles they occupy within the social systems (Torrance, 2010). According to Saldaña (2011) different genres of qualitative research can be used in combination with each other within one study. Therefore, this study used different qualitative methods to explore the research questions through each of the three phases, while using a user centered design (UCD) approach. The researcher's role in a qualitative study is important in all stages and acts as a facilitator through the UCD process (Sanders, & Stappers, 2008). In this study, the UCD process allowed the researcher to explore deeper nuances about the human experience and the role emotions play in product design, led to interesting insights and discoveries (Norman, 2004). The researcher was responsible in helping the users express themselves through a creative design process in this study. According to Sanders and Stappers (2008) this means the researcher lead, guided, and provided scaffolds and clean slates for the designs to encourage users at all levels of creativity and ability. In the case of this research, the researcher brought applicable theories, background knowledge, and literature that helped guide and inspire the design process.

It is also important to acknowledge that the subjects and methods of the research are influenced by a researcher's life experiences, knowledge, identity, beliefs, and attitudes. As a researcher this study was especially meaningful to me because my mother

was previously diagnosed with breast cancer and is now cancer free. I have had some family members who have survived and some who have died from breast cancer.

Given my personal relationship to the study topic, I used triangulation methods to avoid bias in this study. These methods included reflective journaling that was shared with participants, consultations with my pilot participant informant, and consultations with other professional researchers. Both during and after each interview, the researcher journaled reflective notes and memos (Corbin & Strauss, 2008). These notes reflected the researcher's perceptions of data collection and procedures along with emerging themes.

Additionally, it was also important to acknowledge the researcher's epistemology to provide context for this study. Epistemology refers to the researcher's worldview as the basis of knowledge construction (Creswell, 2019). In this dissertation study, the researcher's constructivist perspective supports the idea that knowledge is built through social interactions with others in our environment and that multiple realities and truths can exist (Braun & Clarke, 2013). This paradigm allowed a holistic perspective requiring deeper inquiry and understanding into the multifaceted factors that contribute to one's understanding and knowledge.

For purposes of this study, the researcher defined digital textile print as print designs that integrate photographs, text, shapes, scanned objects, and textile design theories, processes, and digital technologies. Digital software and printing technologies have been associated with developing textile print designs for cloth application (Parsons, & Campbell, 2004). Digital textile printing was used in this study because this technology has the capability to capture photo-real imagery in the creation of individualized, or one-off, surface designs. Prior to the start of this research, the

researcher looked at practices within the digital textile printing and UCD fields (see Chapter 2 for a review of relevant literature). Working alongside the leading researchers in digital textile printing and UCD fields, has helped to inform methods used in digital textile printing and UCD methods.

Given this, the aim of this study was to explore how a designer's (aka the researcher) use of digital textile printing (DTP) technology and the employment of individualized imagery in textile print design evokes emotional responses to DTP. While also using digital printing technology as a tool for creative identity expression and to explore its significance in value to the wearer. Digital technology is not new to our field; however, researchers have not explored the nuances about what attracts people to different textile print designs. Researchers like Donald Norman argue that attraction is complex and involves multiple internal and external factors of evaluation with emotions as a driving force for attraction (Norman, 2004).

### **Data Collection - Rationale**

Four data collection methods were used in relationship to the emotional design theory in this qualitative study including: (a) survey analysis of participant identity expression through dress, (d) semi-structured interviews regarding DTP evaluation, identity expression, and BCS' reflection on value in DTP, (c) written and oral correspondence regarding textile print design prototypes, (d) evaluation of participant's reflective journal and photograph documentation. For a complete interview protocol please see (Appendix B). These methods were used to gather data for incremental analysis to help inform the design prototypes and gain insight into specific factors about how individual female breast cancer survivors express their identity through DTP and

evaluate DTP choices. Existing UCD processes were adopted for designing and refining the DTPs to meet each participant's design criteria. The last interview focused on their reflective experience about their identity expression and value of the textile print.

The following sections address the rationale for the chosen research methods and describe the strategies for application. Using surveys, semi-structured interviews, email correspondence, and journaling/photographs are appropriate methods for data collection in this research study (Appendix D). Specifically, being sensitive to the global COVID-19 health crisis and social distancing requirements, the interviews throughout this study took place virtually, through Zoom, phone, and or face-to-face based on CDC health guidelines. Each phase of this study was conducted separately allowing for the researcher to conduct data analysis between data collection phases. More specifically, Phase I was analyzed and coded to create personal design profiles to help inform the DTP prototype production for evaluation in Phase II of the study. The emerged themes and concepts helped inform the role emotions play in DTP evaluation supporting the emotional design theory (EDT). According to Sanders, and Stappers (2008) using a multistage design process that allows for co-creation early at the front end and throughout the design and development process can have a significant long-range positive impact.

### ***Phase I: Screening Survey***

The aim of Phase I of this study was to explore female breast cancer survivors' identity expression in appearance preferences, and values in DTP. In the initial screening survey, the researcher used a variety of questions with supportive imagery to identify appearance and value criteria specific to the participant as seen in (Appendix B).

Researchers Cosby, Damhorst, and Farrell-Beck (2002) have used visual analysis as a

methodology to document the aesthetic details of dress from pictorial evidence. Their research supports the assertion that nominal forms of measurement are effective in recording styles or types of garments. In this study, visual analysis was used to understand the meanings associated with images, which were categorized by style. This method was reflected in the survey by providing style related images to assess participant aesthetic requirements in DTP designs.

Additionally, values can contribute to behavioral responses in DTP evaluation. According to Rosenblad-Wallin (1985) there are several distinctive symbolic values people assign to apparel products, such as self-esteem, group membership, respectability, fashion, etc. that can contribute to the perception and value a product has to an individual. EDT also emphasizes the important role value plays in user acceptance of a product. Consequently, data collected through the survey about personal values in print design helped inform the first round of prototypes the researcher created between Phase I and Phase II in this study.

### ***Phase II: DTP Evaluation***

Phase II of the study focused on gaining deeper insights into how breast cancer survivors can express their identity through DTP and how they evaluate DTP design choices. This central phenomenon was explored through semi-structured one-on-one interviews. According to Creswell (2015) a central phenomenon is defined as “the key concept, idea, or process studied in qualitative research” (Creswell, 2015, p.16). Research has shown the importance of examining garments collectively and individually (DeLong & Petersen, 1998).

According to EDT, to fully understand the complexities of product attraction you must look at the role emotions play in the evaluation process (Norman, 2004). Norman asserts that emotions run throughout the three EDT levels of (a) visceral, (b) behavioral, and (c) reflection stages of evaluation (Norman, 2004). Therefore, the series of questions in Phase II of this study explored how participants' emotions associated with the provided imagery impacted their evaluation of DTP designs.

Further, the evaluation factors defined by Eicher and Miller's Public, Private and Secret Self (PPSS) model (1994) (i.e., social situation (reality, fun/leisure, fantasy) and level of self-expression (public, private, secret)) were used to support and supplement the EDT used for this study. Therefore, the questioning in Phase II reflected the PPSS evaluation factors to provide additional insight into the considerations made during the reflective stage of evaluation.

Finally, the interviews in Phase II included questions that explored the impact of breast cancer on participant's identity expression and, how their personal values were represented in the DPT designs as seen in (Appendix B).

### *Phase III: Exit Interview*

Phase III of the study focused on gaining a deeper understanding into their reflective experience about their identity expression and value of the textile print. This was explored through semi-structured one-on-one interviews. Therefore, the questioning in Phase III focused on what their feelings were about the co-design process and how it contributed to their identity expression in DTP and what values were represented in their DTP as seen in (Appendix B).

This led to greater insights into how the co-design process created a deeper personal connection to their DTP and identity expression. While also providing additional understanding for the values represented in their DTP. This helped to gain a greater understanding about the reflective evaluation of their DTP and the factors that impacted their identity expression.

Values are an integral part in DTP acceptance, the rationale participants used to express their identity in DTP. This provides a more holistic picture of the participants experiences within the co-design and DTP process.

Furthermore, the questions support the EDT used in this study when looking at the role value plays in user acceptance.

### **Recruitment and Participants**

After approval was obtained from the university's Human Subjects Committee an informational letter was emailed to potential eligible participants (Appendix C) describing the study. Female breast cancer survivors were recruited through purposive and snowball sampling methods, which is the most applicable strategy for participant selection and recruitment. For this study, remission was defined as meaning the disappearance of signs and symptoms of cancer. This definition of remission was also included in the screening survey when participants were asked how long from breast cancer diagnosis to remission. Qualitative studies support the shared experience among individuals is the basis of their selection of participants. According to Corbin and Strauss (2008) random sampling is not a necessary recruitment method in a study when relevant participant criteria is paramount.

The recruitment strategy consisted of making a list of potential breast cancer survivors recommended by acquaintances and personal contacts. A total of eight female breast cancer survivors participated in this study. These eight participants met the level of saturation needed until no new information was seen in the data (Corbin & Strauss, 2008). Table 3.1. summarizes the demographic information of the participants. Participants were vetted through the initial screening survey for participant criteria. For participants who declared to be in breast cancer remission completed the full survey. At the beginning of the survey eligible participants were asked to sign an informed consent form as seen in (Appendix D). Participants consented to have their identifiable imagery released, however pseudonyms were used to refer to them in this study. Participants who agreed to participate in the study were contacted to schedule a semi-structured interview via Zoom, phone, and or face-to-face depending on participants preference. An excel spreadsheet was created to track participant contact and profile information.

**Table 3.1**

*Participant Summary of Information*

Pseudonym	Age at time of Interview	State Location	Profession	Breast Cancer Stage of Diagnosis and Treatment	Years Since Diagnosis	Interview Format
<b>Chelsea</b>	48	Missouri	Biologist-State Government	Stage 1 Hormone Therapy & Double Mastectomy	4 years	Zoom
<b>Michelle</b>	49	Missouri	Physical Education/Health Teacher and Coach	Stage 1 Double Mastectomy	2 years	Zoom

<b>Barb</b>	75	Missouri	Retiree	Stage 3 Chemotherapy, Radiation Therapy, & Double Mastectomy	First diagnosis 16 years ago & second diagnosis 4 years ago (received Double Mastecto my)	In person
<b>Debra</b>	71	Missouri	Retiree	Stage 2 Chemotherapy, Radiation Therapy, & Lymphectomy	24 years	Zoom
<b>Veronica</b>	58	Missouri	Museum Collections Manager	Stage 2 Chemotherapy & Single Mastectomy	13 years	Zoom
<b>Margery</b>	82	Michigan	Retiree	Stage 1 Chemotherapy & Radiation Therapy	9 years	Phone
<b>Natalie</b>	38	Californi a	Content Creator	Stage 1 Chemotherapy, Immunotherapy, & Single Mastectomy	5 years	Zoom
<b>Cynthia</b>	74	Texas	Professor Designer and Business Owner	Stage 2 Chemotherapy, Radiation Therapy, & Lumpectomy	4 years	Zoom

### **Data Collection - Measures**

The following section presents the specific measures taken for data collection during each phase including (a) Phase I - Screening Survey, (b) Phase II – DTP Evaluation, and (c) Phase III - Exit Interviews. A pilot study was conducted with a key

informant who is a breast cancer survivor prior to the start of the full study to provide feedback to the researcher regarding the study design and research instruments. The pilot study informant participated through the whole study and their data was stored and analyzed with the rest of the participants. This allowed the procedures, questions and sequencing, materials, and techniques to be modified before other interviews were conducted.

### ***Phase I: Screening Survey***

Data was collected through an online survey that collected demographics, breast cancer diagnosis/treatment information, appearance preferences that contribute to identity expression, and values important to the wearer. According to Rosenblad-Wallin (1985) symbolic values are humans' emotional judgement of a product based on their socio-cultural environment. In the survey participants were asked what these values (Appendix B) meant to them and to rate them in order of importance. Explanations of these values were provided to the participants for more context and understanding.

The survey also included images of clothing styles, textile prints, and art styles. The participants were asked to select which top three they like most and rate them in order. These images were used to assess the appearance preferences of participants. The images used for inclusion in the screening survey were obtained via the web from online sources such as museum collections of art, and digital textile printing companies. Textile print images were used from textbook *Textile Designs* by Meller and Elffers (2002) and a student example of DTP created in *Textile and Apparel Applications* which I taught during the study design. The sources were identified by conducting a web Google search using the following keywords related to inquiry clothing styles, digital textile prints, and

styles of art (Not sure if this is very clear or if more information is needed). The image categories selected for the survey are based on established styles and placed with corresponding numbers. All valid images were electronically saved and narrowed down to key categories for inclusion in the survey. The survey responses were download in an Excel spreadsheet for further analysis. The data in the survey regarding appearance preferences and values was reviewed with participants at the beginning of the first interview in Phase II for accuracy.

At the end of Phase I – screening survey, participants were given two weeks to provide five-seven personal photos to include in their DTP prototypes. Two participants submitted more than seven photos which in the end helped them communicate a stronger story through their DTP. Participants were asked to keep a reflective journal and share their entry with the researcher prior to the first interview in Phase II. Participants, through the journal, were asked to describe why they selected the photos and their significance to them, and what they liked or didn't like about the photos. In addition, participants were asked to reflect on their favorite printed apparel item they owned in their closet and why it was their favorite. Only four out of eight participants completed their first journal entry. This question was meant to provide additional insight for the researcher/designer when creating participants' DTP prototypes. Participants who completed the journal entry provided deeper insights about their DTP preferences and what factors and values are important to them. This information was used to inform the DTP prototypes, it also revealed factors in their evaluation of a textile print that helped inform questioning in Phase II and Phase III. Half of the participants who overlooked this journal entry said they either forgot or did not recall seeing the instructions. Participants were told they

could still submit it after their first interview, but they did not. It is believed that time and information overload may have been factors in this journal's incompleteness.

The first interviews were scheduled within two weeks of participant's image submission. During this first interview, the researcher, and the participant recapped the importance of the images discussing things such as the meaning, memories, and emotions they evoked as seen in the questions asked in the interview protocol (Appendix B). The data collected from the image journal entry and the first interview helped the researcher understand the emotions and memories attached to their photographs which helped create stronger emotional DTP attachment. Part of the researcher's role was to act as a facilitator and to ensure that the UCD process was manageable for the skill set of the participants (Sanders, & Stappers, 2008).

Digital textile design technologies require skill and training beyond what the participant may be capable of, thus as the researcher who has the specified skills designed the DTP which was printed as scarf prototypes. This reduced the stress of the participant's involvement in the creative process of making the DTP design. The co-creation process allowed collective creativity to occur across the span of the design process with the participant. Sanders and Stappers (2008) define co-creation as "an act of collective creativity that is shared by two or more people" (p.6). This also enabled the researcher to have a holistic view of the participants experiences as they relate to the visceral, behavioral, and reflective levels. Greater insights can be gained by "understanding existing experiences, exploring design ideas, and communicating concepts" (Buchenau & Suri, 2000, p. 1). Giving the researcher the unique advantage to evaluate the experience as well as the prototype. Through this process the researcher

gained a richer understanding of the phenomena by exploring it through prototype creation and experiencing the subtle differences between various design solutions (Buchenau & Suri, 2000).

After the first interview, the researcher used the participant's photographs/images, written explanations of the images, and all previously collected data to develop three-five DTP designs for each participant. Participants also received a set of revised prototypes which ranged from one-ten DTPs. The images were adjusted in Adobe Lightroom Classic to enhance the image qualities the participants identified they liked, this included things such as increase in contrast, brightness/highlights, shadows, colors vibrancy, and sharpening image details. Additional image enhancements were made in Adobe Photoshop adjustments such as resolution increase, image orientation, removal of foregrounds/unwanted objects, healing/cloning for image repair, combining/layering images together, and other image effects/color adjustments were made. For many of the DTP's the adjusted images were opened in Adobe Illustrator, where the images were integrated with other vector elements designed, placed into shapes, used text features, and or added borders.

The researcher found it effective to go between the three adobe softwares in a sequential order based on software capabilities and DTP design requirements. Employing more than one software provided various DTP outcomes to emerge, less design constraints, and increase in meeting participant criteria.

### ***Phase II: DTP Evaluation***

In Phase II, the participants participated in a semi-structured interview to evaluate the individualized DTP designs. Each semi-structured interview lasted between thirty to

ninety minutes. The semi-structured interviews gave the participants the ability to dive deeper into their thinking and experiences with some guidance from the researcher. The focus of the data collected during the beginning of the interview looked at what role DTP plays in breast cancer survivors identity expression. For example, one of the identity questions asked, “Since your breast cancer diagnosis have you experienced a change in your apparel preferences? If so, how? Why? If not, why do you think this is?”

The second phase of the interview focused on what factors breast cancer survivor’s draw upon when evaluating DTP design choices? Participants were asked to evaluate their individualized DTP designs that the researcher developed for them. Each participant had between three and five proposed DTP designs to evaluate. They were asked a series of six questions that repeated themselves for each DTP prototype they evaluated see the interview protocol in (Appendix B). To capture the role emotions, play in DTP evaluation, one question participants were asked is how does this DTP prototype make you feel (e.g., excited, pleasant, calm, neutral, unpleasant)? The data collected identified key forms of identity expression and methods of evaluation in DTP significant to the breast cancer survivor’s needs.

When needed, additional correspondence mostly email and one in person meeting occurred between the researcher and participants regarding modifications of the designs to come to a final DTP design to be used for the scarf prototype production. The final DTP designs were emailed to participants within one week of the interview. This allowed the DTP evaluation to be fresh in participants minds and help validate the researcher’s interpretation of the data collected. In this study, the DTP designs were printed on 40” x 40” scarfs through Contrado a textile printing company based in Britain. In this study, a

scarf was chosen as the end-product to print the design because it could showcase the DTP design without worrying about fit and other confounding clothing-related variables. The researcher emailed participants suggested fabric ideas options with photos and descriptions of fabric choices as seen in (Appendix B). Once the DTP prototypes and fabric was finalized the DTP designs were sent for production.

Each participant was asked to wear trial test their DTP scarf two-three times within a three-week period prior to the exit interview (Phase III). How and where participants wore their scarf was left up to them. After the wear trial testing period was over, the researcher conducted a final follow-up interview to reflect on their user experience in Phase III. During the wear trial period participants were asked to document their wear trial experience in their journal (see Appendix B). This journal collected information about the participant's experiences and emotions felt while wearing their scarf. Reflective journaling can help to understand the thinking, feelings, and positionality of the participants (Meyer & Willis, 2019). Researchers have found the wear trial phase to be rich in data and insights creating new understandings and designs innovations (Morris, & Ashdown, 2018; Coltman et al., 2017). This journal provided participants with an opportunity to reflect on insights into how breast cancer survivor's express their identity through DTP design while validating the role emotions play in the evaluation process of digital textile print design and user experience. As a form of compensation participants were gifted their custom scarf to keep, which is valued between \$40-60 USD without labor cost.

### *Phase III: Exit Interview*

The exit interview focused on the reflections of the participant's wear trial experience, co-design process, and the values expressed in their DTP. Semi-structured interviews were conducted via Zoom, phone, and or face-to-face lasting between thirty minutes to ninety minutes. Meeting after the wear trial test allowed participants to share their final reflective thoughts regarding their experiences and DTP evaluation. This helped to capture data that otherwise might not have been captured in the previous interview. In going into the final exit interview, the researcher analyzed the data collected from the last interview and restructured the final exit interview protocol to reflect thinking as the study evolved. The updates included minor adjustments to the interview protocol to narrow the line of questioning.

The data collected in this Phase helped inform the evaluation process in the previous interview. Participants were asked questions like, "What do you think this textile print design says about you?" Had the exit interview not been conducted the researcher would not have been able to capture how breast cancer survivors express their values through DTP during the reflective stage.

Both the journal kept during the wear trial and the data collected during the exit interview provided rich insight into their wear trial experience. The exit interview allowed participants to expand on their journal entries and wear trial experience of their scarf.

Furthermore, the exit interview allowed participants to express how the co-design process impacted them and what about co-designing was meaningful to them.

## **Data Analysis**

The following section presents the specific methods for the data analysis. The researcher used thematic analysis to analyze data in this study which allowed the researcher to interpret emerging themes regarding participant's perceptions about DTPs (Braun & Clarke, 2013).

In this study, the application of thematic analysis methods provides confidence in ensuring the data accurately represents the phenomena. Thematic analysis is a method for identifying, analyzing, organizing, describing, and reporting themes found within a data set (Braun & Clarke, 2006). Researchers argue that a rigorous thematic analysis can produce trustworthy and insightful findings (Braun & Clarke, 2006). Furthermore, thematic analysis can be a useful method for examining different perspectives, exploring similarities and differences, and identifying unanticipated insights (Braun & Clarke, 2006; King, 2004). Understanding the varying narratives participants contribute can be complex requiring close interpretation. According to Riessman "narratives don't speak for themselves, offering a window into an essential self." In Narrative methods for the human sciences thematic analysis focuses on what is told rather than on the telling (Riessman, 2008).

## **Solo Coding and Trustworthiness**

In this study, the researcher solo coded the data, as defined by Saldaña (2013). Solo coding is when a researcher conducts coding while consulting with a colleague, mentor, or advisor about your coding and analysis. When solo coding data, it is important to use measures of trustworthiness of interpretation. Therefore, the researcher ensured trustworthiness through multiple methods to achieve rigor, validity, and reliability

(Roberts et al., 2019). In this study, rigor was demonstrated through the various data collection methods used such as interviews, written correspondence, and researcher and participant reflective journals. Validity was established through content, criterion-related to themes within and across participants and analysis between researchers, and construct validity of the interpretation of the data regarding the research question (Roberts et al., 2019). The researcher's account of procedures and methods through the reflective journal was used to contribute to the validity of this study as seen in (Table 3.2).

**Table 3.2**

*Trustworthiness in study design*

<b>Credibility</b>	
Prolong Engagement	Interactions with participants over the two interviews.
Persistent Observation	Occur within the two interviews (i.e., emotional triggers, interpretation of data collected).
Triangulation	Method Triangulation: reflective journaling, member checking, and peer debriefing.  Investigator Triangulation: member checks, committee chair will consult during the data analysis process.
Member Checks	Occurred during the production stage of the Digital Textile Print, evaluation of DTP, and exit interviews.
Participant Reflective Journal	The participants kept a reflective journal throughout the study. Participants were given questions to reflect on. Journals included photographs and writing.
Researcher Reflective Journal	The researchers journal accounted for procedures and methods used.
<b>Transferability</b>	
Thick Description	Thick description of the study design and findings.
Purposive Sampling	Both purposive and snowball sampling occurred in the recruitment of participants.

Participant Reflective Journal	The reflective journals contributed to the creditability, transferability, dependability, and confirmability of the study.
Researcher Reflective Journal	The reflective journal contributed to the creditability, transferability, dependability, and confirmability of the study.
<b>Dependability</b>	
Pilot Study	A key Informant matching the participant criteria was used to provide review of the study design.
Member Checks	Participants were given an opportunity to evaluate the interpretation of the findings during the interviews.
Participant Reflective Journal	The reflective journals contributed to the dependability and required participants to reflect on their experiences and evaluation of the findings.
Researcher Reflective Journal	The reflective journal required the Researcher to reflect on the findings as new themes emerged.
<b>Confirmability</b>	
Researcher Audit	The investigator triangulations methods utilizing the committee chair and member checks in the analysis process contributed to the confirmability in ensuring that interpretation of the findings is derived from the data.
Member Checks	Participants were given an opportunity to evaluate the interpretation of the findings during the interviews as the Researcher recapped last discussions.

*Note.* This table demonstrates the multiple methods to ensure the study design's rigor, validity, and reliability.

### ***Credibility***

Credibility was a key factor in establishing trustworthiness. Credibility is defined as defined as whether the research represents plausible information drawn from participants' original data and is a correct interpretation of the participants' original views (Korstjens & Moser, 2018). In this study, credibility was addressed through 1) Prolonged Engagement, 2) Researcher's Familiarity with DTP, 3) Reflective Journaling, 4)

Persistent Observation, 5) Triangulation, and 6) Member Checks. Prolonged engagement was defined as the lasting presence during observation of long interviews or long-lasting engagement in the field with participants (Korstjens & Moser, 2018). To address credibility in my study I met with participants multiple times and demonstrated my DTP technology proficiency while co-designing with participants.

Triangulation employs the use of different data sources of data collection (Korstjens & Moser, 2018). In this study data triangulation occurred using breast cancer survivors' unique experiences over multiple interviews taking place at different times of the day spread throughout several weeks.

### ***Transferability***

Transferability is defined as the degree to which the results of qualitative research can be transferred to other contexts or settings with other respondents. In this study, transferability was addressed through 1) Consulting with Key Advisors, 2) Member Checks, 3) Thick Description, and 4) Purposive Sampling. Transferability was gained by presenting the findings (in Chapter 4) using thick descriptions not only about the participant's experiences, but their context as well, so that the behavior and experiences become meaningful to an outsider (Korstjens & Moser, 2018) and is transferable to other groups. In this study, the researcher addressed transferability when recapping prior data collected during participant interviews based on reflective notes. The participants were also given an opportunity to review the accuracy of the interpretation of the findings, contributing to the study's dependability. Member checks occurred during the production stage of the DTP and at the end of the study during the exit interviews.

Additionally, the researcher arranged meetings with her co-advisors throughout the data collection process to ensure there is no bias of the interpretation and analysis of the findings. The findings relating breast cancer survivors' identity expression in DTP and DTP evaluation has the potential to be applied beyond breast cancer survivors. The findings support the PPSS model and EDT which have much broader applications to the public.

### ***Dependability***

Dependability is defined as the stability of findings over time and involves participant evaluation of the findings, interpretation, and recommendations of the study such that all are supported by the data as received from participants of the study (Korstjens & Moser, 2018). In this study, dependability was addressed through 1) pilot study, 2) reflective journaling, and 3) member checks. Pilot studies are a small study designed to test various aspects of the methods planned for a larger, more rigorous, or confirmatory investigation (Arain et al., 2010). In my study I conducted a pilot study with one of the qualified breast cancer survivor participants to evaluate the screening survey, reflective journal, image selection, and DTP evaluation.

Method triangulation was used to ensure dependability through semi-structured interviews and reflective journaling. Data collection methods in this study allowed for different types of data to be collected in the semi-structured interviews and reflective journals. Both the researcher and participants created reflective journals to creatively express their experiences throughout the study that can be otherwise hard to express in words through the interview process. The reflective journals included photographs and writing, contributing to different forms of data collection. The reflective journals also

provide the opportunity for participants to evaluate their own thoughts during the study increasing the dependability of the data findings.

### ***Confirmability***

Confirmability is defined as the degree to which the findings of the research study can be confirmed by other researchers, establishing that the data interpretations of the findings are clearly derived from the data (Korstjens & Moser, 2018). In this study, confirmability was addressed through 1) Researcher Audits, and 2) Member Checks. Researcher audit refers to a systematic review of processes involved in decisions or actions (Given, 2008). This helped to ensure confirmation and accepted standards were being met. In my study I compared the findings to the Public, Private, and Secret Self (PPSS) model and Emotional Design Theory (EDT) to validate accepted standards.

### **First and Second Round Coding Process and Codebook**

The data collected from the survey, interviews, and journals was transcribed and coded using thematic analysis methods of comparison to explore major themes. Data was gathered and analyzed in Excel which allowed the researcher to label or tag great quotes. Quotes that exemplified the major findings were extracted from the transcriptions. Although quotes help support compelling evidence, the researcher recognizes that the findings are complex and multivariant. Therefore, it was important in this study to contextualize singular quotes with other data across the study design to fully understand the true meaning of the participants (Glaser, 2010). Multivariant findings are defined as a “means to visually investigate complex layers of evidence comprising multiple meanings” (Salmona et al., 2020, p.111).

As mentioned, previously, data were analyzed between each research Phases, which allowed the researcher to follow up on emerging themes and revise questioning as needed as the study progressed.

In general, the data analysis occurred between each Phase of the research and proceeded as described below. In the first round of coding, the researcher reviewed the qualitative data collected across all participants and open-coded the data set to develop the initial codebook in Excel. The codebook included code names, code descriptions, that were organized by emergent themes that appear from the data. In the second stage of coding, the researcher identified connections between concepts. In the second cycle of coding, the Axial coding methods were used to extend from the initial coding. The aim of Axial coding was to strategically reassemble data that were split or fractured during the initial coding process (Strauss & Corbin, 1998, p. 124). Axial coding allowed the researcher to determine which codes in the research were dominant and which were less dominant ones, by reorganizing the data set crossing out synonyms, removing redundant codes, leaving the best representative codes (Boeije, 2010). Grouping similarly coded data reduced the number of initial codes and allowed the researcher to sort and relabel them into conceptual categories. Analytic writing is a critical component of Axial coding with a focus on emergent and emerging codes themselves, along with the category properties and dimensions (Saldaña, 2013). The codebook was continually revised through the coding process.

During the last stage of coding in this phase the researcher analyzed themes across participants regarding DTP design evaluation as informed by the three EDT levels and PPSS model. Data examples from the interviews were used to apply the PPSS model

when understanding the relationship of the three EDT levels and their role in how breast cancer survivors express their identity and evaluate DTP.

### **Key Data Analysis Goals for Each Study Phase**

For Phase I, the primary aim of the data analysis was to identify key characteristics about how breast cancer survivors choose to express themselves through DTP designs. However, this research question would not be answered until the second phase when participants evaluated their DTP prototypes when themes related to the PPSS model emerged. The findings of this data analysis are presented in Chapter 4.

## CHAPTER IV: RESULTS

Chapter 4 contains the following sections: (a) the role of textile prints: to communicate public, private, and secret self, (b) the factors that breast cancer survivor's draw upon when evaluating digital textile print design choices: visceral, behavioral, reflective and emotions, (c) visceral, (d) behavioral, (e) reflective.

To address the research study questions, the analysis focused on understanding the role digital textile prints (DTP) play in female breast cancer survivors' identity expression; and what elements and factors breast cancer survivors' draw upon for evaluating textile print design choices. Research question one is addressed in the first section titled private and public self. Research question two is addressed in the second section visceral, behavioral, and reflective levels of design evaluation.

### **The Role of Textile Prints: To Communicate Public, Private, and Secret Self**

In addressing RQ 1, which explored the role DTP design plays in female breast cancer identity expression, four major themes emerged from the data: *Public Self*, *Private Self*, *Secret Self*, and *Negotiating Breast Cancer Through Public, Private, and Secret Self*. These themes are rooted in Eicher and Miller's Public, Private and Secret Self (PPSS) model (1994) which categorizes dress based on social situation (reality, fun/leisure, fantasy) and the level of self-expression (public, private, secret) (Eicher & Miller, 1994). Initially, the PPSS model was used as parent codes when coding the data set. As the coding progressed, these parent codes became main themes within the data to help understand the role DTP plays in identity expression. Within this main theme, additional sub-themes emerged specific to breast cancer survivors' identity expression.

Overall, all participants explained some aspects of self when evaluating various textile print design prototypes as seen in (Table 4). Breast cancer is a unique experience that survivors decide to either share publicly, privately, or secretly. While some survivors may be more inclined to publicly share their breast cancer experience through textile print design, others are quick to distance themselves from public displays of affiliation. In this study, participants considered multiple factors when considering if the DTP design met their public, private, or secret self-values.

**Table 4.**

*Final outcomes of participants DTP scarves demonstrating how self was represented through photographs used*

Pseudonym	Final Scarf	Pseudonym	Final Scarf
<b>Chelsea</b>		<b>Margery</b>	

**Michelle**



**Barb**



**Debra**



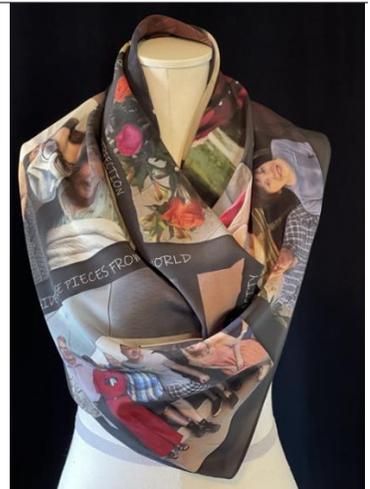
**Veronica**



**Natalie**



**Cynthia**



### *Public Self*

According to Reilly and Miller-Spillman (2016), the public self is defined as the part of a person that is available for others to see. In this study, the participants considered whether the DTP design matched their desired public persona. They considered the images used, colors, composition, scale, and where they would wear their textile printed scarf and who would see it when envisioning the DTP design. All eight participants said they would wear their final DTP scarf publicly. However, only one participant wore her scarf privately in her home during wear trial testing which she attributed to working from home and not having any events that required formal attire. In exploring public self, Michelle (49 years old, physical education/health teacher and coach) was shown a vibrantly colored textile print prototype that made her feel happy. She stated, “I would parade around in this and say look at this, it is cool”. When asked what you want your DTP to say about you, “I want to be sporty, comfortable, and outgoing looking” (Figure 4.1). These findings are consistent with the literature and the PPSS model.

**Figure 4.1***Michelle's DTP Scarf Prototype*

*Note.* This is a DTP prototype that represents Michelle's public persona

In another example, Margery (82 years old, retired) said she could see herself wearing her individualized DTP print in front of others publicly. She saw her personality visually displayed through the design elements used and it matched her desired public persona. Further, six out of eight participants reported that they did not experience changes in their apparel preferences due to their breast cancer experience. Breast cancer does not appear to have impacted most of the participants public self-expression through their apparel.

Overall, when considering the DTP designs based on their personal imagery, they felt that the DTP design should match their public persona that they have built up for themselves. Each of the DTPs communicated different things about the participant such as their roles (mother, wife, daughter, occupation), hobbies/interests, places, events, and

time in their life. The personal images used in the DTP allowed participants to publicly share the things that are important to them. During the wear trial participants reflected in their journal about how they wore their DTP scarf and in what type of social situations they could see themselves wearing it.

According to Reilly and Miller-Spillman (2016), there are three social categories of expression in the PPSS model which include reality dress, fun/leisure dress, and fantasy dress. All eight participants expressed that their DTP scarf fell into the categories of reality and fun/leisure dress for their public expression. Many participants viewed their DTP scarf as a formal item of dress falling under these two categories. Participants reported wearing their scarf to fun/leisure places such as church, volunteer appreciation luncheon, wedding reversal dinner, park, errands/shopping, dinner, social gatherings, doctor appointments, and charity organization event. In addition, some participants reported wearing their DTP scarf to places associated with reality dress like work/volunteering. One participant Natalie chose to wear her DTP scarf tied to her bag she brings everywhere as seen in Figure 4.2. While other participants like Margery who chose to wear her DTP scarf on her body as part of her public expression as seen in Figure 4.2. All participants felt it was important to integrate their DTP scarf into their daily wardrobe without disrupting their public persona. Participants found unique ways of wearing their DTP scarf that appealed to them such as wearing it as a headband, belt, tied around a bag, or tied differently around the neck.

### Figure 4.2

*Examples of public expression in DTP scarf use during wear trial testing provided in journal*



*Note.* Left: Natalie’s bag; Right: Margery. It is important to note that not all participants chose to reflect using photographs.

### *Private Self*

According to Reilly and Miller-Spillman (2016), the private self is that which is presented to friends, family, or other intimate relationships. Under this theme, there were two sub-themes that emerged from the data: *Expressing Breast Cancer Survivorship* and *Exclusivity of Individualized DTP Designs*.

### *Expressing Breast Cancer Survivorship*

When it came to expressing that they were a breast cancer survivor in the DTP design, there was a significant shift in ideals among participants. Being a breast cancer survivor for six out of the eight participants was considered as part of their private self, shared when they felt it was appropriate with friends, family, or other intimate

relationships. They did not feel the desire to overtly display their breast cancer experience through the textile prints they wear.

**Image Selection.** In this study, the participants, seriously negotiated between their public, private self as they considered the images for their DTP designs. There was only one instance where the participant provided an image of ‘iconic’ breast cancer symbolism – which was an internet image of a pink ribbon. Four participants supplied at least one or more photographs related to their breast cancer experience. Moreso, participants provided photographs that symbolically represented the people, events, and memories related to their breast cancer journey. Specifically, two participants mentioned that the photos used in their print did have symbolic representation of their breast cancer experience to them even if it was not explicitly evident to the viewer. Figure 4.3. below shows the symbolic imagery used in Chelsea’s DTP scarf. For example, Chelsea explained how her images were symbolic of her breast cancer experience,

This print has healthy, beautiful, bold flowers, and that’s how I felt when I came out of breast cancer, you would have to know me to get that, but this is what this print represents to me. Chelsea also said, the print reminds me of my mom and the nature photos we share among each other. The flowers and butterfly also represent me as a biologist and how I love nature.

**Figure 4.3**

*Chelsea's DTP Scarf*



*Note.* This is an image of Chelsea's DTP scarf and how the symbolic images used represent her breast cancer experience.

**Demonstrate Breast Cancer Group Membership.** Notably, seven out of eight participants did not feel it was necessary to explicitly express that they were breast cancer survivors through their DTP designs. While five of the eight participants reported that they would wear breast cancer-related apparel, they did not feel it was necessary to demonstrate their breast cancer group membership through the textile prints they wear. For example, Natalie said that her textile print did not have to be identifiably related to breast cancer for the DTP design and prototype scarf to have symbolic meaning related to her breast cancer experience. Natalie had this to say,

It is fine if the print had some affiliation with my breast cancer experience, but it does not have to be identifiable. I wouldn't mind if someone asked me about the

print and what it means, and if the print served as a conversation starter, and I happen to talk about being a breast cancer survivor. I would be open to wearing a textile print that invited the conversation but didn't shout it out in the design.

In the final selection of the DTP prints for the scarf prototypes, seven of the eight participants selected a textile print with photographs not related to their breast cancer experience. All participants selected photographs that allowed them to express and communicate their beliefs, experiences, memories, people, places, and values (Orth et al., 2018).

Only Cynthia's (74 years old, design professor and business owner) final DTP design (Figure 4.7) explicitly centered around her breast cancer experience. She considers her breast cancer experience as part of her public self. From breast cancer diagnosis to remission Cynthia was in treatment for two years. And since then, has had fifteen surgeries related to her breast cancer and reconstruction process. Cynthia had this to say about her breast cancer diagnosis,

At first when I had to go to the cancer center, I was embarrassed and wondered why this is happening to me. And when I began to meet more and more breast cancer patients, I saw places where I could help them and mentor these women. I realized I had been blessed I was given one in nine hundred chances to survive and now I am cancer free, and I need to share my experience with others to give them hope. If clothing will do that, good.

The prototypes Cynthia evaluated she had this to say,

The poem Beautifully Broken should be a focal point of the textile print design as it tells the story of so many cancer patients. It is important for me to share the

unfiltered truth of the journey I have been on. A lot of people don't realize my breast cancer journey as I carried on with everyday life.

This textile print design gives Cynthia an opportunity to publicly share her breast cancer experience with others. While selecting the photos for her print she had to decide if she was willing to publicly share private pictures of herself and her experience as a breast cancer survivor the good, bad, and the ugly.

**Private Meanings.** Further, many of the images used in this study had “inside stories” or meanings attached to them that only the participants understood. Although the DTP designs on a scarf were a public expression of these events/stories, the participants did not necessarily feel compelled to talk to everyone about it. In some cases, the DTP scarf prototypes did help facilitate conversations about their breast cancer experience, which is discussed further in RQ 2.

For example, in exploring the private self, Margery (82 years old, retired) had this to say when asked what if any changes are there in her apparel preferences since breast cancer diagnosis,

I treated breast cancer as a temporary condition, and I attacked it as I was told to and did not let it affect me in any other way. I was very fortunate. I had a very aggressive kind and we caught it early and I am fine, I am well. It was a hick up and that is all.

When Margery was discussing her breast cancer experiences she went on to say,

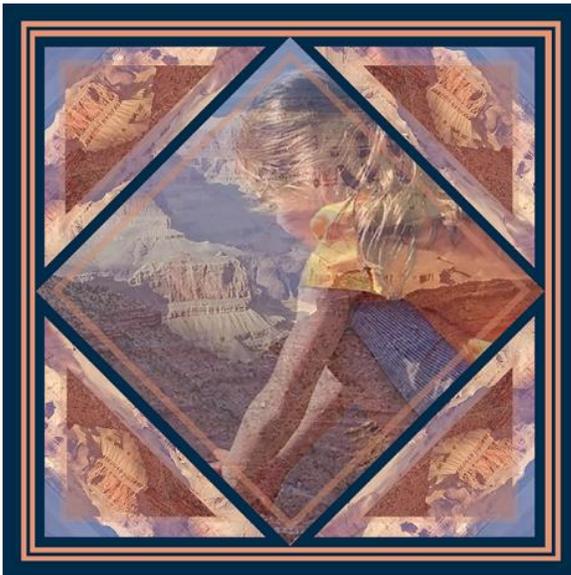
I am in a group it is called the bosom buddies and I have been for a number of years. The girls are all great and when we get together, we don't talk about breast cancer. We talk about everything but, and it is a party each time. But if somebody

has a recurrence everybody supports them like crazy. It is not a boohoo group. It is a yahoo type group. I do not feel the need to advertise I am a breast cancer survivor through my DTP, I do not talk about it at all.

Chelsea (48, Biologist-State Government) was inclined to share her individualized DTP design with those privately in her home but not publicly worn on her body. For example, the memories and people associated with those images was just as important to Chelsea as she stated, “If it were just the Grand Canyon and it did not have the overlay of my daughter, this textile print would not be nearly as meaningful.” To Chelsea, clothing is a unique object that allows for a very personal and tactile experience as seen in Figure 4.4. The relationship humans have with objects allows us to express and communicate our beliefs, experiences, memories, people, places, and values (Orth et al., 2018).

**Figure 4.4**

*Chelsea’s DTP Prototypes*



*Note.* This is one of Chelsea’s DTP prototype’s that she feels more comfortable to privately display in her home.

### *Exclusivity of Individualized DTP Designs*

When considering if the DTP design represented more of her public or private self, Natalie (38 years old, content creator), said “The art and décor prints we use in our home are pretty bold, but things I choose to put on my body are not always as bold,” suggesting the negotiations that she makes between her private (home) and public self (clothing). In Natalie’s case, the exclusive nature of the individualized DTP design influenced her negotiations of public versus private self. Norman and Ortony (2003) found that, brand name, luxury, or exclusive products can induce an emotional response. This can influence whether a textile print would fall under the umbrella of public, private, or secret self. When asked to select a favorite print in their apparel wardrobe to write about in their reflective journal; Natalie chose a bold print that she would not normally wear publicly if it weren’t for the exclusive nature of the product as seen in Figure 4.5. For example, Natalie said,

I like equally the print and the manufacturer who work with the artist to produce limited runs of fabric that are then produced into different apparel items. I am more inclined to purchase this print because it is like you are purchasing a piece of art, it is limited, and there is a sense of exclusivity and you got to get it while you can. I don’t think I would gravitate towards this print as much if it was at Macy’s and I didn’t know the artist and their background. The story sells me just as much as the pattern. There is a sense of comradery among people who wear the same brand and their exclusive products. There is a little bit of ego involved, hoping those who are in the know will recognize the brand and product. I wouldn’t buy it if it weren’t

so practical, comfortable, and wearable and because of this I wear it a lot considering how different it is from other things I own.”

**Figure 4.5**

*Natalie’s Chosen Print Reflected in Journal*



*Note.* This image shows Natalie’s favorite exclusive printed jumper included in her Journal.

Overall, the majority of participants in this study did not feel that their individualized DTP designs needed to literally share their breast cancer experience. Rather, they preferred their DTP designs to include images that represented memories, events, and emotions from their experiences. While several participants were fine with the DTP symbolically representing their breast cancer experience through the images used.

### *Secret Self*

According to Reilly and Miller-Spillman (2016), the secret self is that which is hidden from others. In this project, the secret self was expressed through the images and mood of the DTP designs. For participants in this study, secret self represented emotions they may have felt but did/do not want to share with others. For example, Veronica (58 years old, museum collections manager), stated the black and white DTP design (Figure 4.6) made her feel sad. Veronica said, “at times this print represents how I feel, but that is not necessarily the part of me I want to feel or share with others,” suggesting a secret self of herself. The lack of color and vibrancy contributed to her sad mood. When asked if another more colorful and vibrant prototype matched her personality Veronica, stated “Yes, but I don’t think people would describe me as vibrant, I would hope they would, but I don’t know, and the older I get the less I care.” In this quote, “people” represent public self, but secretly she believes she is a muted person based on how people would describe her.

### **Figure 4.6**

#### *Veronica’s DTP Prototypes*



*Note.* The DTP on left represents the prototype Veronica disliked, while the DTP on the right represents Veronica’s selected DTP scarf.

Veronica's statement indicates that this textile print and the feelings it evokes for her is kept in secret and hidden from others. According to the PPSS model, this feeling could be categorized as assuming another persona. Although Veronica is unclear how people see her, she wanted to project a persona that may counteract what people think of her and that she feels comfortable publicly displaying. If she thinks people in public space do not think she has a vibrant personality she may think the black and white prototype would reinforce this belief.

Cynthia was another example of how the DTP design expressed part of their secret self. Cynthia said,

After my first chemotherapy treatment I lost all my hair within 12 hours and for a long time I wouldn't let anyone see my bald head. I wore a cap at night, so my husband didn't even see my bald head and finally I let him see it about a month afterwards. The picture with my son showing my bald head was even months after my husband saw it. My daughter said I never want to see it; I don't want to see you that way. Nobody else has ever seen my bald head and it was a step of courage to include this picture. I was still the same person whether I look like that or how I normally do, and people still felt the same about me. I think other women need the courage to be able to do that too, which is why I included it.

Cynthia had to make a conscious decision that she was willing to share the photo of her bald head as it was part of her secret self for a long time and not even close family saw it as seen in (Figure 4.7). This means even willing to share it privately with her close friends and family who may not have seen it yet.

When asked how this print matched Cynthia's personality she stated,

The statement you pulled out “Let go of the idea of perfection” captures it perfectly, anything I have ever done I wanted to present this perfectness to the world. If I were upset, I wanted to put that aside and if I was around people be good. This has destroyed that because you can’t always be perfect when you have cancer and so many surgeries, you’re not perfect anymore.

The photos used in this textile print design were considered her private self for a long time just shared with close friends and family. Cynthia has now made the decision to share these private moments with others to encourage them to be brave and offer additional support to those with breast cancer as seen in (Figure 4.7).

Cynthia’s textile print design tells the full scope of her story and the people who have supported her along her breast cancer journey. When asked how the print made her feel Cynthia said,

I thought it would make me sad to go back over and remember all those things, but it really isn’t, it’s a feeling of triumph, I did it, I lived through it, I survived, and to see all the people who have been a special part of my life has been fun. I had forgotten so much of what happened along the way, and this gave me an opportunity to reflect on my personal journey.

Because good emotions resulted in the evaluation of the textile print design it caused Cynthia to be willing to share her private and secret self to the public as seen in (Figure 4.7).



participants interpreted as being worn publicly (although the research did not direct how or where the scarf needed to be worn). These public expressions of private and secret moments through the scarf product may have influenced how the participants chose images and evaluated the DTP designs.

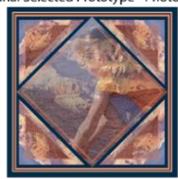
### **Factors That Breast Cancer Survivor's Draw Upon When Evaluating Digital Textile Print Design Choices: Visceral, Behavioral, Reflective, and Emotions**

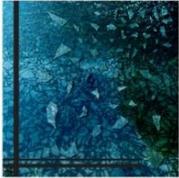
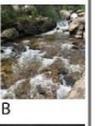
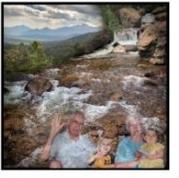
In addressing RQ 2, What elements/factors do breast cancer survivors draw upon when evaluating digital textile print (DTP) design choices, three themes emerged from the data. These three themes parallel Norman's Emotional Design Theory (EDT). Initially, the three levels, visceral, behavioral, and reflective, were used as parent codes when coding the data set. As the coding progressed, these parent codes became main themes within the data to help understand what elements/factors breast cancer survivors draw upon when evaluating digital textile print (DTP) design choices. The themes are therefore aptly titled *Visceral*, *Behavioral*, and *Reflective*. In each of these main themes, additional sub-themes emerged specific to breast cancer survivors' evaluation of digital textile print design choices. Overall, all participants exhibited all three levels of the EDT during the DTP design and evaluation process.

As mentioned in Chapter III, the participants evaluated between three to five individualized DTP designs which were developed from the photographs/images provided by the participants to the researcher. Figure 4.8 shows the top three prototypes selected by each participant and the original images that were integrated into the designs. Figure 4.8 provides a context for the ensuing discussion of the findings.

**Figure 4.8**

*Top three ranked DTP prototypes and corresponding original photos for each participant*

PARTICIPANT PHOTOGRAPH AND PROTOTYPE OUTCOMES					
Participant	Photos Provided BY Participant	Prototypes	Participant	Photos Provided BY Participant	Prototypes
Chelsea	     	 Final Selected Prototype - Photos A & B	Margery	     	 Final Selected Prototype - Photo A
		 Rated Number 2 Prototype - Photos C & D			 Rated Number 2 Prototype - Photo D
		 Rated Number 3 Prototype - Photo F			 Rated Number 3 Prototype - Photo B
Michelle	          	 Final Selected Prototype - Photos A - E	Barb	       	 Final Selected Prototype - Photos A - E
		 Rated Number 2 Prototype - Photos F - I			 Rated Number 2 Prototype - Photo F
		 Rated Number 3 Prototype - Photos J - K			 Rated Number 3 Prototype - Photos A, G, H

Participant	Photos Provided BY Participant	Prototypes	Participant	Photos Provided BY Participant	Prototypes
Debra	 A  B  C  D  E	 Final Selected Prototype - Photo A  Rated Number 2 Prototype - Photos B, C  Rated Number 3 Prototype - Photos D, E	Veronica	 A  B  C  D  E  F  G	 Final Selected Prototype - Photos A - C  Rated Number 2 Prototype - Photos B - G  Rated Number 3 Prototype - Photo G <p>Note: flowers were just an example and meant to be replaced by original images.</p>

Cynthia	 A  B  C  D  E  F  G  H  I  J  K  L	 Final Selected Prototype - Photos A - K  (Tied) Rated Number 2 Prototype - Photos (top) C & L, Photos (Bottom) A - H  Rated Number 3 Prototype - Photos A - G	Natalie	 A  B  C  D  E	 Final Selected Prototype - Photos A, B  Rated Number 2 Prototype - Photo C  Rated Number 3 Prototype - Photos A - E
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*Note.* This figure highlights the most favorable DTP outcomes ranked by participants. It does not include all photos supplied to the researcher nor does it include all DTP iterations.

## **Visceral**

The first theme in this study is *Visceral*, the first level of the EDT. As noted in Chapter 2, Norman and Ortony define visceral response as the evaluation of the perceptual properties and classification of objects (Norman and Ortony, 2003). A person makes classifications to determine if an object is good or bad (Norman and Ortony, 2003). There can be both positive and negative reactions to features within a design. We are often born with an innate and automatic sense of what we like or dislike. These reactions are biological and focus on the current state of the perceived features of an object and can be generalizable across cultures (Norman and Ortony, 2003). In the visceral stage we are subconsciously drawn to the aesthetic features of an object.

When analyzing the data for Visceral-related themes, three sub-themes emerged that all participants expressed while evaluating DTP prototypes. These sub-themes were *Wearable Color*, *Contrast in Color*, and *Identifiable Imagery*.

### ***Wearable Color***

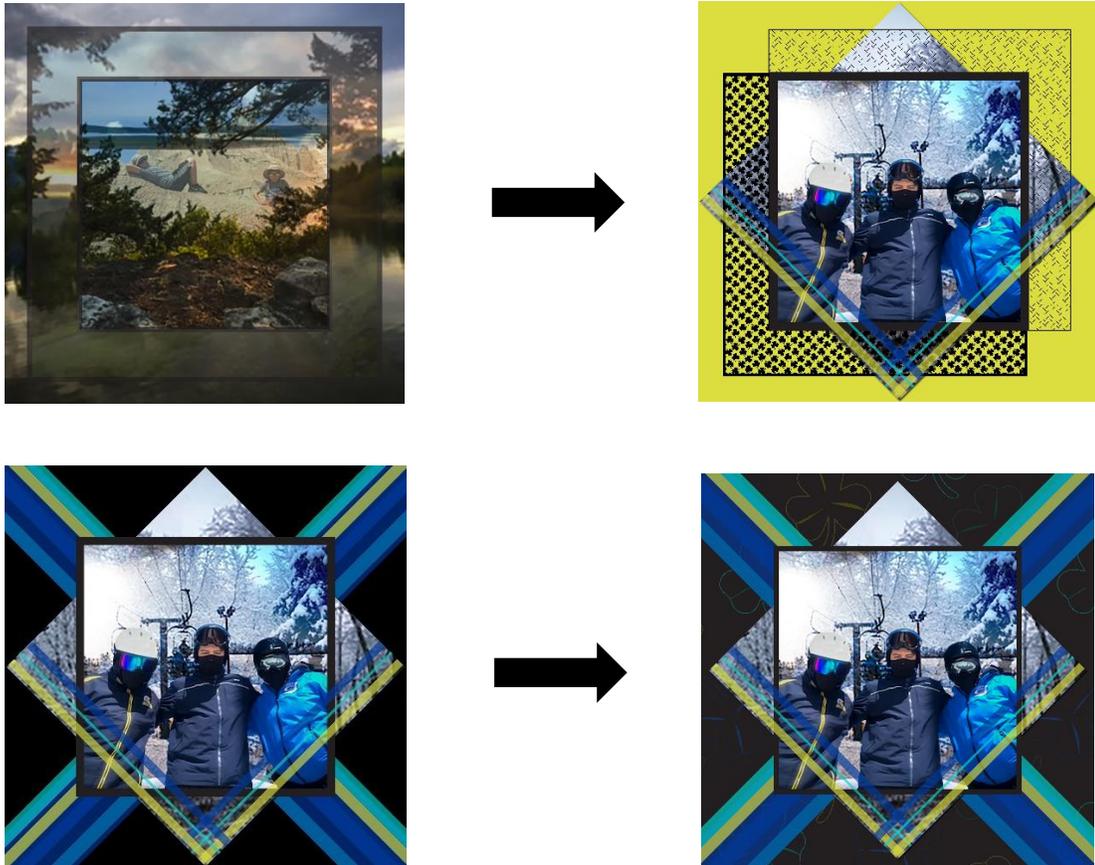
Color played a significant role in the visceral reaction to the DTP design, particularly related to attractiveness of the DTP design. One of the key insights about color in DTP that emerged from the data was that there was a conflict between the colors depicted in the photographs/images they provided and colors that people like to wear on their body. Each participant chose their personal photos to be used within their DTP design, however, even if a participant liked an image, it did not mean the image

possessed colors, they were willing to wear in an apparel item, which in this study was a scarf design.

Color had a direct relationship to how someone felt about a print, it had the power to make them feel happy, sad, or calm. These feelings would later contribute to their behavior of how they understood the DTP design or would use it as a scarf. For example, in the case of Michelle (49 years old, physical education/health teacher) her number one choice was the top left design of Figure 4.9 below, because of the more neutral colors, but the design did not necessarily reflect her self-image. Her number two choice (Figure 4.9, top right) reflected her self-image more than the first print, but it had colors that she would not normally wear. She self-described herself as being a “sporty” person, which played a significant role in her self-image. She said the second print “made her feel happy”, but she was conflicted because she would not normally wear as bright of a color. Given that her conflict between the two DTP options was based on very different color schemes, the researcher developed a third version of the DTP design with a different foreground color and graphic option as seen the bottom left in Figure 4.9. The color change swayed her opinion, and she went this direction for her final DTP design. This design now aligned more accurately with her self-image and the colors she would wear on her body. This design was further refined to include clover graphic elements in the foreground to represent her personal values as seen in Figure 4.9.

**Figure 4.9**

*Progression of colors in DTP designs for Michelle*



*Note.* Top left: Number one ranked DTP print; Top right: Second-ranked print; Bottom left: Iteration of second print; Bottom Right: Final DTP print selected.

Michelle had this to say about how her print made her feel,

Cool. That is pretty, it makes me feel happy. I see that there are clovers on it, and I love that. I like the black foreground and the blue and yellow straight lines, and of course I like the picture, and I like how the squares are set differently and layered.

In another example of how the color of the images may not reflect colors that the participants want to wear on their body, Chelsea (48 years old, biologist) said this about the color of one of the prototypes she evaluated (Figure 4.10):

It is not as bright as my expression. If I am going to have a piece made for me, I want the colors to be bright and bold. I would put this image on my wall and stare at it all day long but as for colors I wear on my body it is too muted.

**Figure 4.10**

*Muted tones of Grand Canyon and Daughter for Chelsea*



In Chelsea's case, the researcher used their design interpretation to modify the imagery she provided into a print design that the researcher thought would be appealing to them while keeping the integrity of the images. The researcher considered factors from

Chelsea's screening survey such as their favorite colors to wear, the style of art they like, the style of prints they like, and their overall clothing style when developing this DTP design. Chelsea's favorite colors were highly saturated orange and blue colors, so the researcher modified the image and print design to project a stronger orange and blue color story. However, it was not strong enough and the colors came across as muted to the participant.

Overall, seven out of eight participants said they wanted bold high saturation color used within their DTP design. The one participant who said they wanted lower saturated color ended up choosing a DTP with high saturation of color for this particular product.

### ***Contrast in Color***

Not only did color (and color saturation) play a significant role in the visceral reaction to the DTP design, but the contrast in color elements within the design also played a major role in how attractive the print was perceived, as discussed in this second Visceral sub-theme. All the participant's final prototype had high contrast in the colors when evaluating their DTP prototypes. It was important to participants that the colors were clear and distinctive. Knowing this the researcher built this element into each DTP design. For example, Debra (71 years old, retired) said this about the contrast in color and elements used in her DTP,

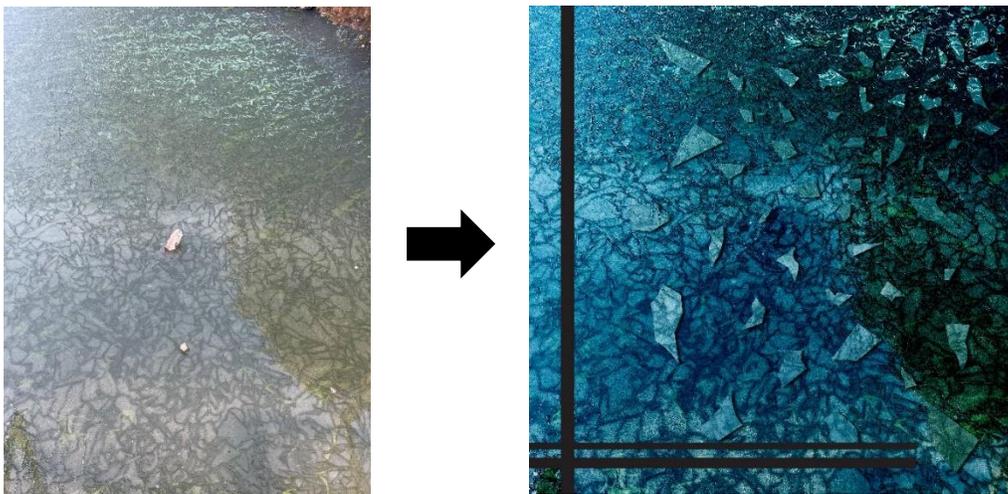
I am just happy and thrilled, and the colors are so rich. I like the little pieces that you have taken out and reshaped, twisted, and highlighted, I like those a lot. Where it goes up into the right-hand corner and there are some white highlights, I like that especially the contrast between the scattered white

highlights and foreground color. I like the contrast of the wildly organic pieces and then the very precise lines on the left and bottom.

Figure 4.11 below shows the original photograph used for Debra's DTP and how the image's colors were modified to include Debra's favorite colors identified in her survey of "blue, especially teal and turquoise; black; greens; dark purples" and how elements with contrasting color were used to create additional design interest.

**Figure 4.11**

*Original colors of photographs enhanced to show contrast in color in DTP scarf*



In another example, Natalie (38 years old, content creator) also expressed that she liked the contrast in colors used in her original DTP as seen in Figure 4.12. She further revised this prototype to add additional contrasting elements. While evaluating this original DTP she had this to say,

I feel happy, I like the picture, so I am happy it is the emphasis. I like the colors and they are like tribal animalistic abstract. I noticed how the lighter colors of the print were picking up the lightning bolt look on her shirt and the contrasting shades of color.

**Figure 4.12**

*Natalie's example of clear and contrasting colors*



*Note.* Original DTP evaluated is pictured on the left and the final revised DTP is pictured on the right.

### ***Identifiable Imagery***

In addition to wearable color and contrast in color, all participant's DTP had to incorporate identifiable imagery into the design increasing their visceral emotional reaction. Said in another way, the DTP elements must be identifiable and reinforce the message being told through the imagery used.

Using photos and design elements that were easily identifiable was important to participants as they were trying to make sense of the overall design. If the images and or message of the design was not identifiable to the participant, it reduced their emotional response and impacted their visceral attraction negatively. Notably, some effects placed on the images served as a deterrent and caused a negative reaction because it hindered the identifiability of the image. For example, while Chelsea was evaluating prototypes, she had a more significant negative reaction to one of the DTP designs because the filter

effect placed on the image and composition of elements did not reinforce the same emotions as the original image provided (Figure 4.13). The image Chelsea supplied had significant meaning and value in her breast cancer journey, but the DTP design fell short of their expectations. Chelsea had this to say,

A picture tells a story, and you don't want to break it out or change it. I do not feel connected, by adding the boarder it disconnects from the memory. It is altering the original picture maybe too much. The boarder does not go with the old fashion dining room and buffet. Putting the modern contemporary boarder around it washes out the feeling of the original picture. I am less likely to wear this print on a scarf.

**Figure 4.13**

*Chelsea's image criteria when evaluating one of her DTP design's*



*Note.* Original image is on the left, while the DTP prototype is on the right. The DTP contains a subtle filter effect on the image and a 3D geometric boarder.

The images, supporting graphics, and colors used in the DTP need to enhance the connection between each other to communicate a cohesive message. Sometimes, the

designer's decisions during the DTP design process can cause the wearer not to have the same strong emotional connection they once had to the images used. The imagery used needs to support the overall message being communicated and, in this study, the images used in the final DTP should still be identifiable.

In the case with Cynthia (74 years old, design professor and business owner), it was very important to keep the integrity of the emotions the images evoked for the participant within the DTP design (Figure 4.14). In this case, Cynthia provided images with people in them, so the researcher created a print that kept the people identifiable to not distract from the importance of her people in her breast cancer journey. Cynthia had this to say about imagery used in her DTP as seen in Figure 4.14.

I love it, I absolutely love it. I love the black background with the white text through the cracks. The black background makes the pictures show up better. I prefer the black boarder to frame the images. I was drawn to all the faces, you really captured everybody up-close they are very clear and distinct you can see details and things; I like that. It is very warm, all of the people that were a part of my journey are included.

**Figure 4.14**

*Keeping the images of people identifiable in Cynthia's DTP design*

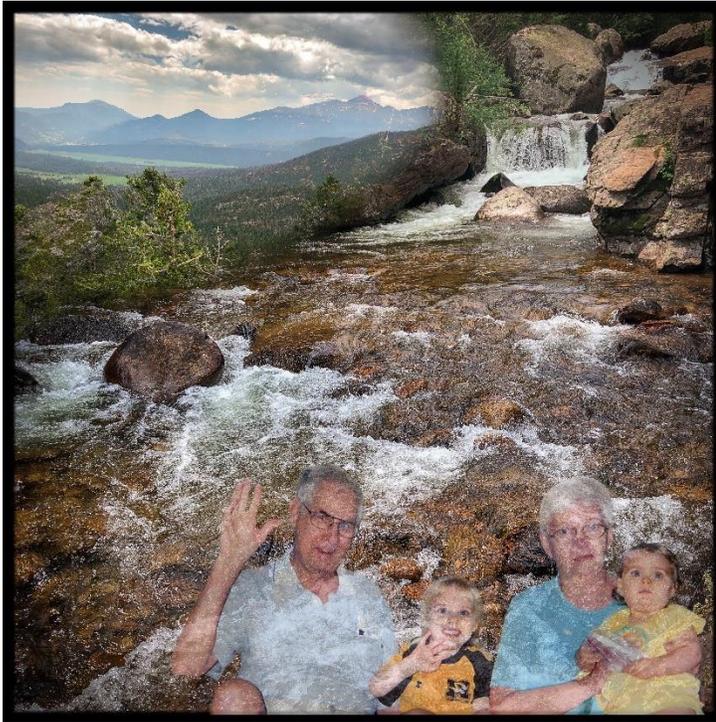


Even when blending multiple images together it was important that the overall message and images were clearly identifiable even if it was subtle. Veronica (58 years old, museum collections manager) expressed her visceral reaction to the identifiable images in her DTP as seen in Figure 4.15. She said this of her design:

I am intrigued by the people in the stream and how it works. I would not have expected it to work that well and I guess I am intrigued by that part, but they are subtle, so it is something that you have to look in more detail to realize what is there, but I like it. I like the blending of people with the other images together. I like the three images blended together, if you take one away it is not as interesting.

**Figure 4.15**

*Veronica's DTP design showing how to blend images of people and landscapes while keeping all images identifiable*



In another example, Barb (75 years old, retired), preferred seeing imagery that is in its natural state. She did not like to see images placed out of context and she was not the only participant to feel this way. Several participants who submitted photos using natural objects like flowers, tree, bushes, etc. did not want to see them appearing differently than how they naturally grow or mixing plants from different seasons. Imagery identifiability played a significant role when Barb was evaluating prototypes as seen in Figure 4.16 below and said,

There are a lot of white dogwoods floating, I think if the image showed the white blossoms were attached to something, that might change my thoughts on it, I don't know. I don't like the yellow tree in there because

the white and purple are all spring things and the yellow is almost winter, they seem out of place together. I like the purple and white together, that is a good combination. There is a lot of busyness in it.

**Figure 4.16**

*One of the Prototypes shown to Barb during DTP evaluation*



*Note.* Multiple factors such as color, effects, and blending of images as seen all contributed to Barb's assessment of image identifiability in the DTP design.

Creating a print with abstract features and mixing seasons of plants made the images less identifiable and in turn decreased her visceral reaction. The ability to make sense of the message and images used was an important element that all final DTP possessed. For participants who do not like abstract art, it was more difficult for them to

make sense of the imagery when it was taken out of its original setting and blended. The abstract elements also reduced the images identifiability.

Overall, regarding visceral-level reactions the participants in this study reacted to both the saturation and contrast of the colors used in the DTP designs. The colors had to not only reflect their personalities, but also be colors they would wear on their body. Furthermore, the images needed to be easily identifiable to help the viewer understand and make sense of the design.

### **Behavioral**

The second main theme that addressed RQ 2 was *Behavioral*. Behavior is a learned response which is subconsciously processed and automatic (Norman & Ortony, 2003). Behavioral response is the predictions and expectations of the near future and when a product design fails these expectations can evoke an emotional response to the product design (Norman & Ortony, 2003). All participants made predications regarding their behavioral response in the evaluation process of the DTP design. Additional behavioral responses were observed during exit interviews following the wear trials at the conclusion of the study. Within the *Behavioral* theme, there were two sub-themes:

*Design Enhances Emotions and Wearability Predictions.*

#### ***Design Enhances Emotions***

Participants were given full agency to select their personal photographs to include in their DTP designs. How these photos were translated into a design with other elements influenced their behavior regarding whether they would wear the DTP design, particularly a scarf, or not.

During the design process, the researcher had to interpret meaning from sometimes a seemingly disparate collection of photographs/images. This was the case with Margery (82 years old, retired) who provided images of some of her favorite things around her home. None of the images had a strong connection between each other. In this case the researcher used the descriptions she provided me about why she selected the images to create graphic elements that enhanced and evoked similar emotions she felt about the photograph. This, along with their survey responses, helped inform me about her preferences and incorporate these findings into her DTP design. Figure 4.17 below shows an original image Margery provided alongside the DTP design from this single image. Margery had this to say about how her DTP made her feel.

I feel happy, I looked at it and thought oh wow I love it, I feel great. I like the motion of the design around the lady it is a still life and motion at the same time, lots of motion with the black and white drawing around it. I noticed the design around the oval first and how beautifully they went together, like it was made to be together. The composition is great.

**Figure 4.17**

*Marjory's original image and DTP Prototype that focuses on one main image*



*Note.* The left image is the original photo, and the right image is Margery's DTP scarf design.

Margery's examination of the DTP design caused her to reflect on what this design communicated to her, how she saw herself reflected, and whether she would wear it as a scarf as stated below. Her reflection on her self-image directly lead to her predictions of wearability.

It is a woman with attitude she is not a wishy-washy person. She speaks her mind and I admire that which is what drew me to the picture in the first place. It is dramatic and I tend to be dramatic sometimes, not on purpose, but it is just my nature. She reeks of confidence. It would be the biggest pleasure to wear this.

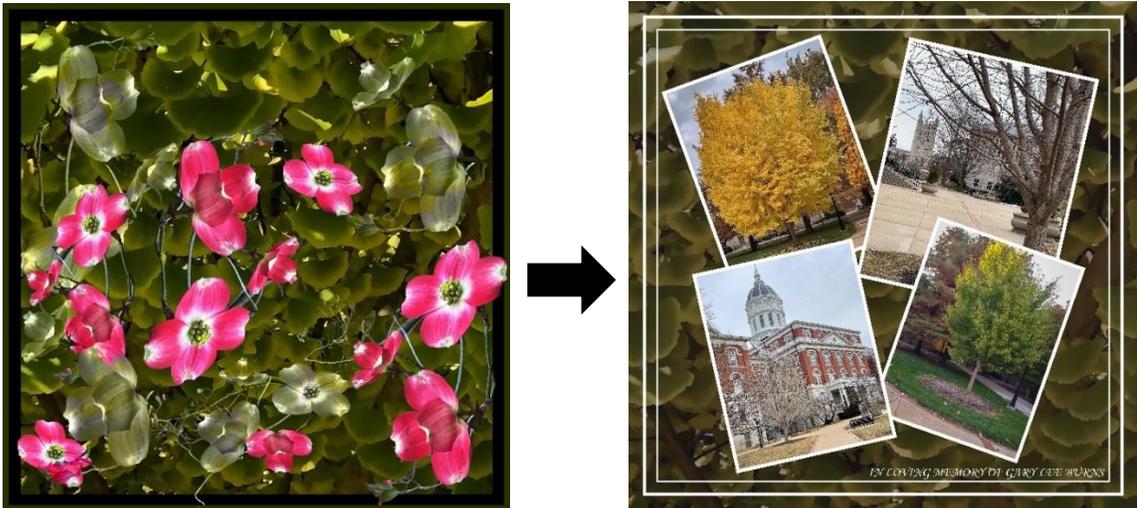
Depending on the images and how it was integrated into the design some images did not translate into a desirable DTP. During this process, the researcher made decisions on what and how many of the participant's images to use in the DTP design. The researcher tried to make cohesive compositions based on the images the participant's provided, which at times was difficult because not all images provided to me complimented each other. In some situations, the researcher decided to use a single image to create a strong design that would elicit an emotional response versus using all the images provided.

These designer decisions may have impacted some of the reactions to the designs. For example, after showing Barb four DTP designs (Figure 4.18) and not seeing any DTP that provided a significant positive emotional response, I went back to the drawing board. She really liked her husband's tree that was planted in memory of him, and it created a strong emotional response for her when discussing it. Therefore, I went to the location of the tree and took additional photographs that I could use to tell a more cohesive story throughout her DTP design. The additional photos allowed me to capture other elements that provided context, identifiability, and elements that were meaningful to her. Additionally, it created a stronger message causing it to evoke a stronger emotional response. Using my design intervention influenced whether she liked the imagery used: saying,

I like that you put a picture of Jesse Hall and Memorial Union in. It rounds out the story of where it is. He walked pass that corner every day at least twice if not four times a day. The images are very sentimental to me, I really like it.

**Figure 4.18**

*Left: Barb's 4<sup>th</sup>-ranked DTP design; Right: Final DTP design*



These changes played a significant role in the emotions she felt and the connection she had to the DTP design.

Overall, the design composition, layout, colors, filters, should amplify the participant's embedded meaning in the images used in the DTP design. The design and images used in tandem of each other play a significant role in the emotions they felt when evaluating the DTP design. Further, it was found through this design process, that not every image holds the same level of meaning or emotions associated with them. A person can like the photos in the design and be inclined to wear it, but that does not mean it is the DTP they connect with the most emotionally. As seen in Figure 4.19 Natalie's chose a final DTP that centered around her daughter, although, she indicated she would be most inclined to wear another prototype with an origami design as seen in Figure 4.19 because, "I would wear the origami the most, but it is because it is the most incognito, but it doesn't mean it is the one that resonates with me emotionally the most".

### Figure 4.19

*Left: Natalie's Final Prototype that she connects with most emotionally; Right: 3<sup>rd</sup> ranked Origami prototype that she felt she would be more inclined to wear because of its easy integration into her wardrobe*



Overall, the participant's emotional connection to the DTP design, and images used therein, played a significant role in their decision-making process and behavior. All elements need to work together to create an emotional connection to the DTP design.

#### ***Wearability Predictions***

The second sub-theme was *Wearability Predictions*, or whether they said they would wear the DTP design as a scarf. Knowing the DTP design would be printed on a scarf factored into their behavior and how they felt about the DTP design.

In this study, the fact that the product was a scarf did negatively impact some of the participant's intended wearing behavior. Five out of eight participants reported that they do not wear scarves and three out of eight participants reported that they wear scarves only occasionally. For example, Chelsea said the scarf was a limitation for her

because she was unsure about how often she would be able to integrate it into her wardrobe. When Chelsea was determining whether she would wear her DTP as seen in Figure 4.20 she had this to say,

It also includes pinks, and I could see where this would be appropriate to wear a lot of pink like at a Relay for Life event, or an October Pink 5K run, or a Pink Game. This print has healthy, beautiful, bold flowers, and that's how I felt when I came out of breast cancer, which is meaningful to me. Yes, I would absolutely wear this as a scarf.

**Figure 4.20**

*Chelsea's Final DTP Prototype Scarf Design*



During the wear trial testing Chelsea did not wear the scarf publicly but rather wore it in her home. This was due to her working at home at the time. However, she did discuss events she would wear the scarf to during the evaluation of the DTP and after the wear trials.

Seven out of eight participants wore their scarves publicly two to three times or more during the wear trials between Phase II and Phase III of the study. Five out of eight participants found it difficult to integrate their scarf into their normal wardrobe. During the exit interview after the wear trial was complete all participants said they would possibly wear their scarf again. Five out of eight participants were more confident that they would wear their scarf again. All said they would keep it, however, some said they would keep it in storage as a keepsake, display it in their home, and or pass it down to their children. For example, Debra's scarf as seen in Figure 4.21 had this to say about what she intends to do with the scarf after the study,

I am keeping the scarf, absolutely, I love it, I love the way it feels, I can't wait to try out some of the other ways to wear it or tie it. Because I have more of a connection to it, I am going to want to wear it more than some of the other ones I don't have a connection with.

**Figure 4.21**

*Debra's Final DTP Scarf Design*



Barb had a very difficult time seeing herself wearing a scarf both during the evaluation and the wear trials. However, once she helped to co-create a DTP design that she felt comfortable wearing, it enhanced her feelings toward wearability (Figure 4.22). Barb had this to say about her predictions of wearability, “I will wear it, probably not frequently, but I will wear it. I will keep it and I will pass it down to my daughter”.

**Figure 4.22**

*Barb’s Final DTP Scarf Design*



All participants viewed their scarves as a keepsake item. Even though they all varied in what they plan to do with it or if they would wear it again, each participant said they plan to keep it or pass it down to their family members. Each participant said that because the scarf was customized with images that were meaningful to them, it influenced what they plan to do with the scarf.

Overall, the content of the DTP design in combination with the scarf product influenced the participant's behavioral responses. Although not all participants felt comfortable wearing a scarf product, the findings within the sub-themes of *Enhancing Emotions* and *Wearability Prediction* could be easily transferred to different apparel-based products. Regardless of product type, the DTP design should enhance the emotions of the imagery used in the designs. Further, visceral responses had a significant contribution on the participant's behavioral response and wearability predictions. As discussed in the following section, the participant's anticipation of the wearability of the DTP design on the scarf prototype was further evolved through the wear trials, once the participants had a chance to reflect on the DTP design in different use scenarios.

### **Reflective**

The final theme, *Reflective*, showed how having participants use their own imagery maximized the level of self-reflection when evaluating DTP choices. According to the EDT, the reflective level is conscious and provides understanding, monitoring, and self-examination of one's actions and perceptual self-image (Norman & Ortony, 2003). The personal imagery used in the DTP designs helped to support a personal connection between the DTP design and the participant. Reflective level responses typically overcome the visceral level of emotions (Norman & Ortony, 2003). In addition, the reflective level is significantly influenced by experience, culture, social groups, and age (Norman & Ortony, 2003). One's social role can also cause the reflective level to change (Norman & Ortony, 2003). Within the reflective level people can display emotions such as pride, shame, disgust, and gratitude (Norman & Ortony, 2003). During the reflective

stages of DTP evaluation two sub-themes emerged under Reflective: *Values Represented in DTP* and *Closure Through DTP*.

The wear trials provided participants with an additional opportunity for reflection on how the DTP design represented their *values* as breast cancer survivors. Mainly, the reflection came out through the exit interviews where participants discussed the values represented in their DTP designs. During the exit interviews, the participants discussed their reflection of the images used in the DTP design and the meaning the DTP prototype represented for them.

### ***Values Represented in DTP***

The DTP prototypes, and the images used therein served as a catalyst of the participant's personal values as represented in their DTP designs. Four of eight participants included images of people in their final DTP design. One participant included an illustration of a woman in their images. Regardless if the DTP included images of people, each DTP design reminded participants of their relationships with others. Six out of eight participants said during the wear trials they were able to build stronger relationships with others through discussing their scarf and participation in the study. For example, Margery stated "To me the scarf is a great conversation piece, I love to talk about it". For many of the participants the scarf served as a conversation starter and helped them strengthen relationship with others during the wear trial testing. These experiences added to the value of the scarf. The personal connection one had with their DTP was discussed in the reflective stage of evaluation and contributed to the behavioral responses of participants as observed in above examples provided. The relationships and memories made with others as captured in their photographs/images was a significant

value they felt was important to have represented in their DTP designs because it was important for their breast cancer journey.

Seven out of eight participants felt that because of the individualized DTP design, they could better express their values. For examples, Cynthia (75 years old, designer professor and business owner) had this to say when discussing how her values were represented in her DTP scarf:

This scarf demonstrates my beliefs, I am passionate about mentoring others who are in the same situation, and I think this is a really good tool to do that with. I am not nearly as concerned with the perception and status of the scarf. When looking at my scarf someone said you obviously value people. I have always said people are more important than things and people are our lives. They are what make life important, what makes life fun and joyful. It is the part of yourself that you plant in other people that lives on. The custom scarf helped me to be able to better express myself because the scarf almost told the story itself because there were pictures from each phase. The scarf made it so easy to say: hey I want to share something with you. This is unique and different and special to me, and I want to share it with you. It was so easy to share, and they were so enthusiastic about it. If you are wearing the print you are more open to sharing it.

For Cynthia having something that she could wear impacted how she was able to communicate with others and express her values. Her DTP scarf served as a tool to open discussion regarding her breast cancer experience. For a long time, Cynthia carried on with her everyday day activities and did not share this private part of herself with others. The DTP scarf allowed Cynthia to build stronger relationship within her community and

social circles. Having it on her body made the telling of her story easier and more accessible for her and for others.

However, Margery did not feel as strongly that a customized print allowed her to better express herself and had this to say,

Maybe, customizing is an expression, but I do not need to customize to express myself, it is another way to express yourself. I was able to get excited and tell the story of the scarf. The story is just as important as the scarf to me. I enjoyed telling the story just as much as wearing the scarf.

It is certainly true that participants could express themselves without having something customized. Seven of the eight participants did feel that using their own images in their DTP allowed them to better express themselves and their values. Margery took pleasure in talking about the co-design process and how the scarf was made rather than what values it expressed about her.

Natalie reflected on how her DTP design (Figure 4.23) helped keep positive memories top of mind. She said,

When going through photos I wanted to choose photos that triggered more than how cute is she in this picture. That is why in the picture of her on her phone I remember thinking she was so into lady Ga Ga. This photo was at her pre-school which is no longer there and it was such a near and dear place for us so there is a bunch of emotion associated with that.

**Figure 4.23**

*Natalie's Final DTP Prototype and Emotions Associated in the Reflection Stage of Evaluation*

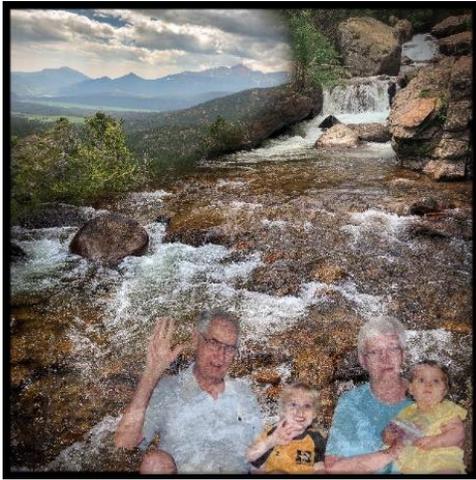


During the evaluation stage Veronica reflected on what made her DTP as seen in Figure 4.24 so valuable to her, “This print has all the things that are important to me: family, mountains, streams”. She elaborated in the exit interview why the DTP design was so valuable to her and said,

The fact that there are images in there of family made quite a bit of difference. If I had selected images of all these beautiful outdoor scenes and they meshed well stylistically, I am not sure it would have made as much impact as the fact there was that one image that was important the people.

### Figure 4.24

#### *Veronica's Final DTP and The Values and Emotions it Represents*



The images used in Veronica's scarf were not only representative of her values, but emotions were strongly associated with the images used. When Veronica was asked what her DTP design says about her, she had this to say,

The scarf represents to me the importance of family and to be honest the importance of family is a very important thing for me to think about right now. The views of the outdoors and Colorado that is one place where I feel the presences of God more, I think that is why natural scenes strike me so much. In some ways it is really about beliefs and what is important.

The process itself forced me to think about who I am and what are my values and expressing those. I think it's not just the wearing it, but it is the process as well.

In another example, Michelle's DTP design caused her to reflect on memories made as seen in Figure 4.25, while having this to say,

It brings back good memories; I am proud that I can hang with those kids. I like seeing us three together and I like that background. The background is special, the skiing, the lift, the challenges we do, we cut through the trees, we do crazy stuff together the boys and me. Sometimes we get stuck, and it makes me think of the times when we might have to call 911.

**Figure 4.25**

*Michelle's DTP and The Values and Emotions it Represents*



After the exit interview, she had this to say when asked about what her scarf says about her, “My scarf says I am athletic, I am lucky, all about family, the colors are calm and fun”.

The four participants who did not use photos of family and friends in their DTP designs still demonstrated that the DTP print represented their personal values. For example, Margery’s DTP design (Figure 4.26) had this to say during the evaluation stage,

It is dramatic, and I tend to be dramatic sometimes, not on purpose, but it is just my nature. If I am going to do something I am not going to do it

halfway it is going to be done right, everything I do I want to do to the best of my ability.

**Figure 4.26**

*Margery's DTP and the values it represents for her*



Margery reflected her self-image through the images used in her DTP design. She values and takes great pride in how she chooses to present herself. Margery discussed the importance of being bold in the statements she made through her DTP. After the wear trial test while Margery reflected on what her scarf communicates about her, she had this to say,

I think the scarf communicates that I am always hunting for something new, and I like to share it with my friends. If I find something that would be interesting to them, I am very much an individualist. I don't follow the crowd; I like to lead the crowd. I like to start the trend rather than join the trend.

Overall, the participants explained how their DTP reflected who they are and how they felt which can be interrupted into what they value.

### *Closure Through DTP*

Co-designing the scarf provided a sense of pride in the outcome of their DTP design, and it also caused participants to reflect on their breast cancer experience. The DTP design and co-design process gave the participants an opportunity to reflect through the design process, which allowed them to commemorate their journey and how far they have come. Five out of eight participants expressed that the scarf allowed them to reflect, commemorate, and close the chapter on their breast cancer journey. Two of the participants said they found closure in the process of reflection rather than the scarf itself.

During the wear trial participants were asked to reflect on their experiences wearing their scarf in their reflective journal. Cynthia publicly wore her scarf as seen in Figure 4.27 a total of seven times in different public settings during that time. Cynthia provided detailed journal entries about her interactions with others, one of her entry's states,

I had an appointment with my oncologist today, so I took my scarf. She loved the idea and said that she had noticed a difference in my talking about the cancer experience. She said that I was more upbeat, but she had contributed that to the fact that I was at the end of my treatment. Now she is wondering if the scarf helped me go through those memories again and finally say goodbye. I think she may be correct.

**Figure 4.27**

*Cynthia's DTP and the closure it provided her*



During a follow up appointment with Cynthia's surgeon, her surgeon stated she thought everyone should have this experience as a part of their healing at the end of their journey. Although Cynthia is in remission at the time of this study, she was still undergoing reconstruction. Cynthia's breast cancer journey was still very fresh in her mind and the timing of this study helped her to reflect and have closure. During her exit interview Cynthia had this to say,

I think it cut a lot of years off me dealing with and closure time because I think it would have taken me a whole lot longer to go through, I might not have even looked back at my journal for a couple of years after all this is over. Because of doing this I went back, and I looked at my journal and I looked at pictures that we have taken, and I probably would not have done that for a couple of years until I became curious about it again. I think it did a lot to help the people around me because they were seeing these

things caused them to listen more when somebody says I have been diagnosed. It has really helped my closure.

After the wear trial test during Chelsea's exit interview, she expressed how her scarf and the co-design process helped her to reflect and find closure. Chelsea's scarf as seen in Figure 4.28, served as a tool to commemorate her breast cancer experience and here it what she had to say,

Just having it enhances my feeling of how far I have come and the thankfulness now I have this piece that represents nostalgia, its bold and I know it doesn't specifically in itself say you survived breast cancer, way to go, but it represents the things I am still able to enjoy, the bright colors, the bold, the being out there and doing everything. It enhances my perception of myself, that I have this piece to celebrate that. It serves as memorial to my life journey. It symbolizes life after breast cancer for me, it is colorful, vibrant, and alive and it is all my favorite things.

**Figure 4.28**

*Chelsea's DTP and how it represents closure for her*



Participants like Natalie who's scarf as seen in Figure 4.29 served as a tool to acknowledge the milestones they made since their breast cancer. For seven out of the eight participants the process allowed them to reflect on their breast cancer experience and have an object that commemorates their reflection. During Natalie's exit interview she had this to say about how her scarf served as a way for closure,

This print falls into breast cancer survivor group membership, but I like that it doesn't necessarily shout that. It is like a quiet group membership which is what I prefer. I thought this was fun. Last October was my five-year breast cancer anniversary. It came and went. We were distracted and I was expecting covid. I don't know if we would have necessarily celebrated per say had it not been. This was just good timing. It gave me an opportunity to acknowledge my anniversary and reflect on it so the timing of your piece could not have been better in terms of just giving me pause to appreciate where I am.

**Figure 4.29**

*Natalie's DTP and how it represents closure for her*

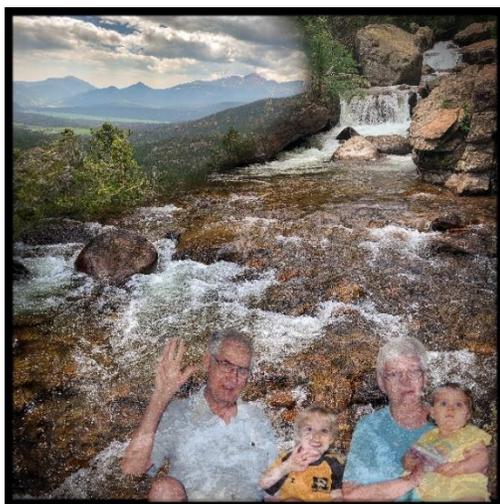


During Veronica's exit interview she reflected on how the co-design process impacted her and had this to say about how her scarf as seen in Figure 4.30 represents closure to her,

It has now been thirteen years since my breast cancer diagnosis, I was talking to someone about how I finally got to a point where I don't think about it every day, so it had me thinking about it again with a little more perspective. In terms of that breast cancer was something big and we made it through it. Being a co-designer helped me think through what is really important as opposed to everything that was going on around me. In the end it had a great deal of value to me because it helped me through a really bad week. The fact that I have it and foresee another really bad week, I think it would make me feel better to wear it if I am going to be in situations where I am not happy and I need to be reminded of the important things in life.

**Figure 4.30**

*Veronica's DTP and how it represents closure for her*



Participants going through the co-design process allowed them to think more critically about their life and what is most valuable to them. Upon reflecting on the DTP design Debra had this to say about her breast cancer journey,

I feel like that in life to it is the imperfections that are interesting and all the imperfections that sort of hold a personality together and make you who you are. I used to say breast cancer was the best/worst thing that happened to me. The worst was all the treatments, fear, and the unknown and the best was that I appreciated every day that I had. I realized how important friends were and to have a community to be with because the support that I got from my community, my church, and my friends was amazing, unbelievable. I would have probably been more self-centered and not realize that if it hadn't been for the breast cancer.

Only one participant Margery did not feel that the process of reflection or the scarf created any type of closure for her breast cancer journey. Margery stated she was diagnosed with an aggressive form of breast cancer; it was caught early at stage one, and she underwent both chemotherapy and radiation treatment. From the time of diagnosis until remission was six months, it has been nine years since her diagnosis. Margery states, "I treated breast cancer as a temporary condition, I attacked it as I was told to and I did not let it affect me in any other way" (Margery, personal communication, February 10, 2022). It appears that for Margery it was important to move pass this experience as quickly as possible. Due to catching her breast cancer at an early stage, and the treatment she underwent allowed her to enter remission quickly which may have also played a role in this mind set.

This study, through the DTP print and/or co-design process gave participants an opportunity to reflect on the values their DTP expressed and whether it aligned with their self-image, which caused either a positive or negative emotional response. Participants demonstrated the emotional connection they had to their scarf and how it provided psychological comfort and closure for them.

Each participant went through their own unique journey and was grateful to be here to tell their stories. Through DTP and using personal images, the participants reported reflecting on memories and creating stronger personal connections. Further, the co-design process and personal images used increased the value of their scarf to them.

Overall, the reflective-level responses showed a culmination of visceral and behavioral-level responses. In this study, the visceral and reflective stage influenced their behavioral response. The three levels of evaluation were interconnected causing their visceral reaction to lead to reflection of self-image, which informed their behavioral response. The emotions felt and expressed in the reflection stage by participants caused them to assign value to their DTP, which in turn impacted their behavior. Further, the personal images used in their DTP contributed to their emotional attachment to their DTP. Additionally, the participants involvement in the co-creation process also contributed to attachment and the emotions felt toward their DTP.

As discussed previously, during the Visceral stage participants expressed factors such as image color wearability on the body, contrast in color elements, and image identifiability within the DTP design played a significant role in DTP attraction. Further, in the behavioral stage participants demonstrated how their DTP enhanced the emotions they felt, which led to their predictions of DTP wearability. And lastly, during the

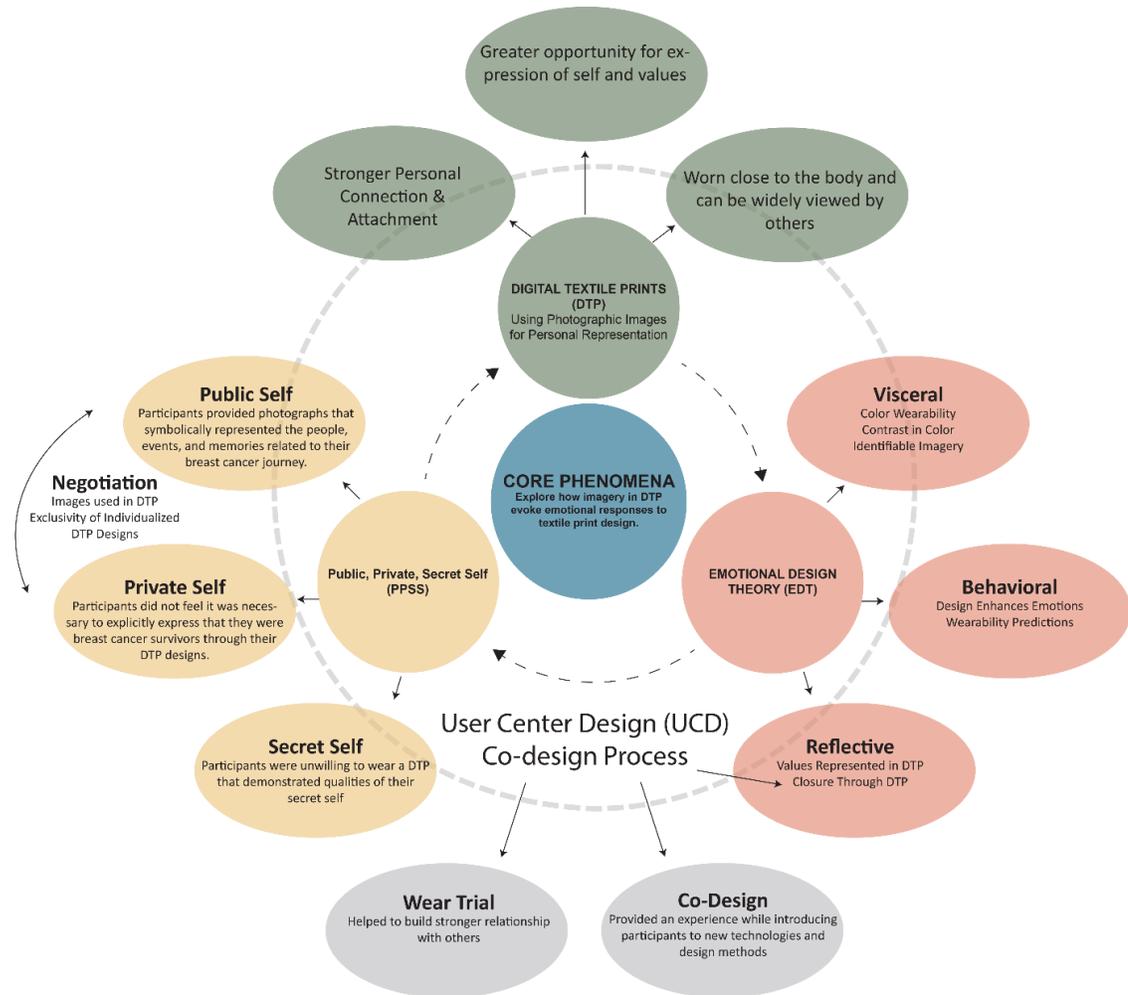
reflective stage where participants were most expressive about the value their DTP had and the closure their DTP gave to them. In the end through the three levels of evaluations participants were able to co-create a DTP that met their personal needs and made them feel good about themselves.

Further, in this study, the visceral, behavioral, and reflective response during the evaluation of the textile print helped the wearer to determine whether a print meets the criteria of their public, private, or secret self. More specifically in the reflective stage participants articulated how their self-examination met their PPSS. The wear trial demonstrated behavioral actions taken or not taken by participants that impacted how the DTP scarf reflected their PPSS. Additionally, the visceral stage impacted what factors attracted participants to their DTP design. The participants then had to weigh in the reflection stage through self-examination whether these factors aligned with their PPSS.

The study design was supported by the PPSS model and Emotional Design Theory (EDT). EDT was adapted to the UCD process to include the use of digital technologies in a creative and multifaceted design production process. The study design allowed the researcher to capture results in visceral stage during Phase I and Phase II, while the behavioral and reflective results were captured throughout the entire study design. As illustrated (Figure 4.31) below are the key findings as they relate to DTP, theories (EDT and PPSS), and UCD process.

**Figure 4.31**

*Diagram of key findings as they relate to DTP, theories (EDT and PPSS), and UCD process*



## CHAPTER V: CONCLUSIONS

Chapter 5 contains the following sections: (a) overview of the study, (b) summary of findings, (c) contributions and implications, (d) limitations and future research, and (e) research reflection.

### **Overview of Study**

#### ***Research Goals and Objectives***

The aim of this study was, (a) the role digital textile prints (DTP) play in female breast cancer survivors' identity expression; and (b) what elements and factors breast cancer survivors' draw upon for evaluating textile print design choices. To achieve the objectives of this study, a qualitative approach was used to address the research problems and unknown variables (Creswell, 2019). This allowed for rich insights to be gained through thick descriptions and explanations (Miles et al., 2014). In this study, the UCD process was used to allow the researcher to explore deeper nuances about the human experience and the role emotions play in product design, led to interesting insights and discoveries (Norman, 2004).

To explore the central phenomenon with employment of the UCD process this study was conducted in three phases: (a) Phase I: Screening survey, demographics, and forms of identity expression, (b) Phase II: Semi-structured interviews with breast cancer survivors exploring identity expression, and digital textile print (DTP) evaluation, and (c) Phase III: Semi-structured exit interviews focused on their reflective experience about their identity expression and value of the textile print. Between Phase I and II, the

researcher created the customized DTP scarf prototypes. While between Phase II and III the participants wore their customized DPT scarves in wear trials.

This study adds to the body of knowledge and what is known about identity expression and evaluation of DTP. Donald Norman's Emotional Design Theory (EDT) (2004) and Eicher and Miller's Public, Private and Secret Self (PPSS) model (1994) contributed to the study's design. The PPSS model was used to explore breast cancer survivors' identity expression through DTP. Exploring how public, private, and secret self was displayed through breast cancer survivors' imagery for inclusion in their DTP. Emotions control much of our product evaluation and EDT helped to support the exploration of what factors and elements breast cancers survivors draw upon to evaluate DTP choices.

### ***Literature Gaps***

The research questions used for this qualitative study explored the gap in literature. Specifically, diving deeper into the complexities and forms of identity expression and evaluation processing of DTP. Much of the research in DTP has been explored through the history and application of DTP technologies (Parsons, & Campbell, 2004; Ridgway et al., 2017). However, no studies using DTP have applied EDT to explore the role emotions play in user evaluation of DTP. Furthermore, there are no studies within the textile and apparel field that have used UCD practices to elicit the role emotions play in identity expression and DTP evaluation.

### ***Justification***

Considering breast cancer is the most commonly diagnosed cancer among American women (Breastcancer.org, 2022) and is one of the most recognizable cancers

around the world. Most of the research in the textile and apparel field has focused on the apparel functional needs or body image of breast cancer survivors as it relates to their treatment and reconstruction (LaBat et al., 2016; Dhawan et al., 2022; and Nicklaus et al., 2020). Currently, there are more than 3.8 million women with a history of breast cancer in the U.S., this includes women currently being treated and women who have finished treatment (Breastcancer.org, 2022). Foundations like, The National Breast Cancer Foundation (NBCF) and Breast Cancer Research Foundation (BCRF) are synonymous with its “Go Pink” campaign using the pink ribbon on various products to raise awareness and money for breast cancer research. However, little is known about how breast cancer survivors prefer to express themselves through apparel products. More specifically, their willingness to share with others this very personal and private experience.

There are many tools and technologies available to allow creative expression through apparel to occur. However, DTP technologies are unique in the way that is allows breast cancer survivors to use their personal imagery to creatively express themselves and their experiences. Using personalized photographic imagery with DTP technology allowed breast cancer survivors to be the architect of the messages and meanings they convey in the construction of their identity through dress. This can help them to create novelty prints that are more meaningful to them and better express their values. This sense of personal connection to their apparel can increase the value an object has.

Given breast cancer is highly marketed and has impacted so many women it important to explore their needs of expression and how they choose to communicate their group membership to others. It is important for stake holders such as designers,

healthcare professionals/breast cancer organizations, educators, and survivors themselves to have a greater understanding about forms of identity expression and factors considered during DTP evaluation.

## **Summary of Findings**

### ***Identity Expression in DTP***

To address the gaps of literature, this study explored breast cancer survivors' identity expression in DTP. In this study, the participants, seriously negotiated between their public, private, and secret-self as they considered the DTP designs, and this was fraught with complexity. These public expressions of private and secret moments through the scarf product may have influenced how the participants chose images and evaluated the DTP designs. In this study, when selecting images to be included in their DTP, participants had to negotiate what images they were willing to share of their private/secret self with others. Four participants supplied at least one or more photographs related to their breast cancer experience. Moreover, participants provided photographs that symbolically represented the people, events, and memories related to their breast cancer journey. Specifically, two participants mentioned that the photos used in their print did have symbolic representation of their breast cancer experience to them even if it was not explicitly evident to the viewer. Overall, all participants explained some aspects of self when evaluating various textile print design prototypes.

Breast cancer is a unique experience that survivors decide to either share publicly, privately, or secretly. Notably, seven out of eight participants did not feel it was necessary to explicitly express that they were breast cancer survivors through their DTP designs. Rather, they preferred their DTP designs to include images that represented

memories, events, and emotions from their experiences. While several participants were fine with the DTP symbolically representing their breast cancer experience through the images used. Being a breast cancer survivor for six out of the eight participants was considered as part of their private self, shared when they felt it was appropriate with friends, family, or other intimate relationships. While five of the eight participants reported that they would wear breast cancer-related apparel, they did not feel it was necessary to demonstrate their breast cancer group membership through the textile prints they wear.

Each of the DTPs communicated different things about the participant such as their roles (mother, wife, daughter, occupation), hobbies/interests, places, events, and time in their life. The personal images used in the DTP allowed participants to publicly share the things that are important to them during the wear trial testing. Many of the images used in this study had “inside stories” or meanings attached to them that only the participants understood. Although the DTP designs on a scarf were a public expression of these events/stories, the participants did not necessarily feel compelled to talk to everyone about it. In some cases, the DTP scarf prototypes did help facilitate conversations about their breast cancer experience. Overall, when considering the DTP designs based on their personal imagery, they felt that the DTP design should match their public persona that they have built up for themselves.

### ***DTP Evaluation***

This study explored; what elements and factors breast cancer survivors’ draw upon for evaluating textile print design choices. To best understand this research question, themes for this study parallel Norman’s Emotional Design Theory (EDT) and

are aptly titled *Visceral*, *Behavioral*, and *Reflective*. In each of these main themes, additional sub-themes emerged specific to breast cancer survivors' evaluation of digital textile print design choices. Overall, all participants exhibited all three levels of the EDT during the DTP design and evaluation process.

**Visceral.** Three sub-themes relating to the visceral level emerged which were *Wearable Color*, *Contrast in Color*, and *Identifiable Imagery*.

Color played a significant role in the visceral reaction to the DTP design, particularly related to attractiveness of the DTP design. One of the key insights about color in DTP that emerged from the data was that there was a conflict between the colors depicted in the photographs/images they provided and colors that participants like to wear on their body. Even if a participant liked an image, it did not mean the image possessed colors, they were willing to wear in their DTP scarf design. Color had a direct relationship to how someone felt about a print, it had the power to make them feel happy, sad, or calm. These feelings would later contribute to their behavior of how they understood the DTP design or would use it as a scarf.

Not only did color (and color saturation) play a significant role in the visceral reaction to the DTP design, but the contrast in color elements within the design also played a major role in how attractive the print was perceived. All the participant's final prototype had high contrast in the colors when evaluating their DTP prototypes. It was important to participants that the colors were clear and distinctive.

In addition to wearable color and contrast in color, all participant's DTP had to incorporate identifiable imagery into the design increasing their visceral emotional

reaction. It was important that the DTP elements were identifiable to help the viewer understand and make sense of the design.

**Behavioral.** Within the *Behavioral* theme, two sub-themes emerged: *Design Enhances Emotions* and *Wearability Predictions*.

Overall, the design composition, layout, colors, filters, should amplify the participant's embedded meaning in the images used in the DTP design. The design and images used in tandem of each other played a significant role in the emotions participants felt when evaluating their DTP design. Further, it was found through this design process, that not every image holds the same level of meaning or emotions associated with them. A person can like the photos in the design and be inclined to wear it, but that does not mean it is the DTP they connect with the most emotionally. All participants expressed different emotions during the evaluation of the design of their DTP's specifically as it related to the images used. Overall, the participant's emotional connection to the DTP design, and images used therein, played a significant role in their decision-making process and behavior. For participants all elements needed to work together to create an emotional connection to the DTP design.

During the evaluation process participants made prediction of whether they would wear the DTP design as a scarf. Knowing the DTP design would be printed on a scarf factored into their behavior and how they felt about the DTP design. In this study, the fact that the product was a scarf did negatively impact some of the participant's intended wearing behavior. Five out of eight participants reported that they do not wear scarves and three out of eight participants reported that they wear scarves only occasionally.

However, without mandating they wear their scarf publicly, seven out of eight participants wore their scarves publicly two to three times or more during the wear trials between Phase II and Phase III of the study. Although, Five out of eight participants found it difficult to integrate their scarf into their normal wardrobe. Given all this, after the wear trial all participants reported they would possibly wear their scarf again. However, five out of eight participants were more confident that they would wear their scarf again. In this study, all said they would keep it, however, some said they would keep it in storage as a keepsake, display it in their home, and or pass it down to their children.

Even though not all participants felt comfortable wearing a scarf product, the findings within the sub-themes of *Enhancing Emotions* and *Wearability Prediction* could be easily transferred to different apparel-based products. Regardless of product type, the DTP design should enhance the emotions of the imagery used in the designs. Further, visceral responses had a significant contribution on the participant's behavioral response and wearability predictions. The participant's anticipation of the wearability of the DTP design on the scarf prototype was further evolved through the wear trials, once the participants had a chance to reflect on the DTP design in different use scenarios.

**Reflective.** During the reflective stage of DTP evaluation two sub-themes emerged under Reflective: *Values Represented in DTP* and *Closure Through DTP*.

During the *Reflective* stage, it was found that having participants use their own imagery maximized the level of self-reflection when evaluating DTP choices. The personal imagery used in the DTP designs helped to support a personal connection between the DTP design and the participant. Participants reflective level responses

typically overcome their visceral level of emotions (Norman & Ortony, 2003). Further, the wear trials provided participants with an additional opportunity for reflection on how the DTP design represented their *values* as breast cancer survivors. These findings came out through the exit interviews where participants discussed the values represented in their DTP designs.

During the exit interviews, the participants discussed their reflection of the images used in their DTP design and the meaning the DTP prototype represented for them. Four of eight participants included images of people in their final DTP design. One participant included an illustration of a woman in their images. Regardless if the DTP included images of people, each DTP design reminded participants of their relationships with others. Six out of eight participants said during the wear trials they were able to build stronger relationships with others through discussing their scarf and participation in the study. For many of the participants the scarf served as a conversation starter and helped them strengthen relationship with others during the wear trial testing. These experiences added to the value of the scarf and personal connection they had with their DTP. These interactions with people also contributed to their behavioral responses.

The photographs/images used in their DTP showed the relationships and memories made with others. This captured the significant value they felt was important to have represented in their DTP designs because for some it was important for their breast cancer journey to include such relationships and memories made. Seven out of eight participants felt that because of the individualized DTP design, they could better express their values. Overall, the participants explained how their DTP reflected who they are and

how they felt which was interpreted into what they value. All participants images represented either explicitly or implicitly their relationship with people they value.

During the exit interview upon reflection, five out of eight participants expressed that the scarf allowed them to reflect, commemorate, and close the chapter on their breast cancer journey. Two of the participants said they found closure in the process of reflection rather than the scarf itself. Only one participant did not feel that the process of reflection or the scarf created any type of closure for her breast cancer journey. The DTP design and co-design process gave the participants an opportunity to reflect through the design process, which allowed them to commemorate their journey and how far they have come and to reflect on their breast cancer experience. Further, co-designing the scarf provided a sense of pride in the outcome of their DTP design. In the findings participants demonstrated the emotional connection they had to their scarf and how it provided psychological comfort and closure for them.

Overall, the reflective-level responses showed a culmination of visceral and behavioral-level responses. In this study, it was found that the visceral and reflective stage influenced their behavioral response. The three levels of evaluation were interconnected causing their visceral reaction to lead to reflection of self-image, which informed their behavioral response.

### **Contributions and Implications**

This study contributes to the body of knowledge and what we know about how breast cancer survivors use public, private, and secret self (PPSS) to evaluate their identity expression. Among, the different forms of identity expression through dress, this study also contributed to the body of EDT research and how breast cancer survivors

evaluate DTP designs. This adds to EDT and what is known about how emotions play a role in evaluating DTP. Within the field of fashion DTP research has not explored what factors are considered in the selection process and what draws a person to one DTP over the other. This can have significant contributions to the DTP design research field and how designers, researchers, and educators use DTP to create stronger emotional connections for the user.

### ***Public, Private, and Secret Self Model***

This study's findings support Eicher and Miller's PPSS model which categorizes dress based on social situation (reality, fun/leisure, and fantasy) and level of self-expression (public, private, and secret) (Eicher and Miller 1994). When evaluating their DTP prototypes during the reflection stage of self-examination, participants considered factors such as where they would wear their scarf and if the design aligned with their public self-image. The PPSS model helps to support Norman's Emotional Design Theory and which factors participants considered during the three levels of evaluation (visceral, behavioral, reflective). The findings revealed that emotions play a significant role in determining if a DTP was part of their Public, Private, and or Secret Self. How the DTP made participants feel determined whether they would wear the print publicly on a scarf.

The imagery participants selected for their DTP reflects the first step of PPSS evaluation. Images were carefully evaluated by participants as they determined what they were willing to share. In the case of Cynthia, she carefully evaluated if she was willing to include the picture of her bald head in her DTP. Her bald head was kept in secret for a long time before her making the decision to share it with the world around her. The second round of PPSS evaluation happened during the reflection stage of the DTP

evaluation when participants had to determine if the DTP aligned with their PPSS. Some prototypes caused some participants like Veronica not to want to share certain parts of herself with others. As seen in a black and white prototype that made her feel like her private self and not something she was inclined to publicly share.

Breast cancer was a unique experience that some either share or keep private. It was found in this study that for six out of eight breast cancer survivors this was a part of their private self-shared with close friends, family, and other intimates and not something they felt their DTP had to express. These participants were fine with their DTP symbolically representing their breast cancer but it did not need to be explicitly represented in their DTP; however, five out of eight participants did report wearing breast cancer related apparel or accessories. The dichotomy in their PPSS was demonstrated in how participants chose to express themselves in their DTP. The PPSS model helps to further enlighten how people evaluate their self-image when selecting what they choose to put on their body. The findings support the notion that regardless of people's experiences, the PPSS model is still used to determine what digital textile prints someone is willing to wear.

### ***Emotional Design Theory (EDT)***

The PPSS model helps to explain the findings during the reflective stage, while findings further support the three levels in Donald Norman's Emotional Design Theory of visceral, behavioral, and reflective responses to designs. The findings further contribute to how emotions play a role during the evaluation stages. These emotions were strong enough to persuade participants to choose one prototype over another as seen in Natalie's response when she chose her final DTP over another due to a stronger emotional

connection. Spite the other prototype being easier to integrate into her everyday wardrobe. This demonstrates and supports Norman's theory that people are emotional thinkers rather than rational.

In turn, having a positive emotional reaction increases the value of a DTP. Additionally, this demonstrates that our emotions can override the visceral levels of response causing differences in behavioral responses. The findings also support that our favorite objects are those that have a story and that we have a personal connection to. This was seen when participants integrated their own images of memories that they made in their DTP which created a stronger emotional attachment for the wearer. DTP is a unique tool that allowed participants to use their imagery that held personal meaning to them to tell their stories through design. This required the researcher to carefully examine and observe in order to determine what was most meaningful to participants.

The findings also support EDT that an object ultimately is there to fill a need. As seen in Veronica's reflection after her wear trial test her scarf filled an emotional need to be reminded of her values and the people who are important to her. Her scarf fulfilled a psychological need for comfort when she felt distressed. Regardless if participants wore scarves in their wardrobe, they were willing to wear their DTP on a scarf because they had an emotional attachment from the images used and were co-creators in the design process which significantly influenced the value the scarf to them. In addition to self-examination during the reflective stage, participants also reflected on memories made in the images used within their DTP.

Unique to this study it was found during the visceral stage that color of images did not mean they translated to colors worn on the body. Color played a significant role

in DTP attraction. During the visceral stage, it was found that the photo images used needed to be identifiable for the emotional reaction to occur. If images were distorted too greatly the participants lost their emotional attachment to the image as seen in Barb's responses. It was not until pictures were left intact with some simple layering that Barb began to have a positive emotional reaction. The findings from this study add to what is known during the three levels of evaluation specifically as it relates to DTP.

### ***Implications***

Linking the PPSS model with the EDT provides great contextual understanding about how breast cancer survivors express their identity through DTP and evaluate their DTP choices. This provides insight into implications for designers, healthcare/breast cancer organizations, educators, and survivors. For designers this study's findings show how creating a personal connection to digital textile prints will create greater emotional attachment and product value for the consumer. It was also found that engaging the consumer in the design process as a co-designer also creates stronger product attachment and meaning for the wearer. Currently many designers and product developers do not engage consumers in the design process, however, much can be learned about what triggers a consumer's emotional response while working with them during the design process. This study shows the benefits of engaging the consumer in the design process. While demonstrating the importance of gathering information about the consumer's likes, dislikes, and needs. This requires careful examination as many consumers do not necessarily know what they want. It is up to the designer to interpret the consumer's needs. It was found that technology like DTP was an effective tool for customizing prints that had significant product attachment for the consumer. Even though the participants in

this study are breast cancer survivors, some of the findings have broader applications to the general public. This study provides a deeper understanding about what breast cancer survivors are willing to share with others about their experiences. Designers will want to consider these factors when creating prints that are meaningful to consumers.

In addition, healthcare providers and other breast cancer organizations will want to consider how DTP may be used to express breast cancer survivors group membership. It was found in this study that breast cancer survivors group membership was not often publicized through their apparel. There is a lot of breast cancer related apparel and accessories on the market. Although the participants were breast cancer survivors many of them chose not to wear breast cancer related apparel in their daily wardrobe. These organizations may want to consider other forms of expression for breast cancer survivors that relate more closely to their expression of identity. Timing of when breast cancer survivors are most likely to want breast cancer related apparel varies. Participants viewed this type of item as a way to commemorate milestones in their breast cancer journey like at end of treatment and or anniversaries.

This study found that having a custom DTP and co-design process allowed for breast cancers survivors to reflect on their experience with greater perspective while providing closure. This opportunity of reflection was found to be therapeutic for breast cancer survivors. As one of the participants reported in their reflective journal, her physicians saw positive mood and behavioral changes when the participant was talking about her scarf as it related to her breast cancer experience. Additionally, her physicians noted that this could have similar therapeutic effects for other cancer patients. Using DTP to create custom apparel products is a unique form of expression compared to other forms

of art therapy that are not publicly displayed on the body. Apparel products worn on the body lends a unique experience for public displays of self-expression. It was found in this study that having a custom DTP allowed breast cancer survivors to share their journey with others, provide psychological comfort, build stronger relationships, commemorate, reflect, give opportunities for creative self-expression, and provide a sense of closure. Healthcare professionals may want to consider how they can support breast cancer survivors or other types of cancer survivors in commemorating these milestones as a form of art therapy using a co-design process through custom DTP apparel products. In this study participants were eager to close this chapter, this is important in the healing process and can provide great emotional comfort.

This study helps to inform Educators who mentor future designers to be more conscious about how people express their identity through dress. Educators may want to consider techniques used in this study to train future designers about how the co-design process can engage underserved segments of the population with special needs. These techniques can be integrated into the classroom to teach student how to co-design with the consumer and problem solve during the design process, while using their design intervention skills to create meaningful product outcomes. Additionally, this study's findings provide insight into how people evaluate design and how emotions play an active role in peoples decision making process. More specifically, this study's finding provide greater understanding about what design elements are consider in the attraction of DTP. The findings help future designers to create more successful print designs for other various target consumers. It is important for Educators to teach students critical

thinking skills throughout the design process that can be adapted to various technological and production changes.

The Survivors themselves can gain insight from the findings of this research. The findings show how digital textile printing technology within the apparel field can be used to express individual identity. Most people are unaware of how they can use their own personal imagery to create prints that are more meaningful to them. This can help survivors have greater understanding and encourage them to seek opportunities for them to creatively express themselves. The study's findings also provided insight into how other survivors may view their breast cancer journey and may find comfort in having shared experiences.

## **Limitations and Future Research**

### ***Limitations***

During the execution of this study much was learned about the limitations of this research and opportunities for improvement. First this study includes a small sample of participants, narrowing the scope of measurable data. However, the methods used allowed for rich insight and understanding regarding the research questions. One of the more significant limitations of this study was that most participants said that they did not wear scarves this had direct impact on their understanding of how the DTP was used during their behavioral response. I did not anticipate participants having such a negative reaction to wearing a scarf. This impacted the overall value they rated their scarf based on their perceived understanding of usability. Although, having a scarf did allow much of the focus to be on the DTP itself, which is why I chose a scarf. Going forward future studies would benefit from exploring other product applications. The knowledge gained

from DTP application in this study could be applied to a variety of products such as bags, shirts, pants, dresses, and jumpers that better align with user's functional needs. Applying DTP on products that meet the user's functional needs will increase their understanding of how the product is used, overall attraction, use of product, and DTP attachment. The outcomes of this study emphasize the importance to develop products that meet both the emotional and functional needs of users within DTP design.

Although applying personal images of people like seen in the outcomes of this study on different products could have its own sets of design and user acceptance challenges. For scarves that incorporated people the scarf allowed participants to twist and scrunch it in different ways creating some anonymity, however I do not know if participants would feel the same about their DTP design if the DTP was applied to a shirt and more visible on the body. However, for participants who used more natural scenes of nature, trees, flowers, water, etc. it could be more user accepted. If these DTP designs were applied to other products, I think the design composition would need to be displayed in different repeating pattern orientation verses a single non-repeating pattern as seen in participants scarf design outcomes. The types of personal photos and images used would need to be renegotiated based on product outcomes. For many of the participants, using personal imagery was an outward expression of their private selves. Display of self can change depending on the products used. Some of the participants in this study alluded to this in the evaluation stage saying their DTP design decision would be based on the product outcome. In many U.S. cultures, rarely do people wear photographs of events and loved ones as a graphic expression on the body (with

exceptions being tattoos, memorial t-shirts, family reunion t-shirts, theme-park souvenirs, etc.).

Meeting with participants virtually was a limitation especially for those who were not technology savvy. This impacted my ability to co-create with some participants live so they could see immediate changes. For one participant who was local I quickly adapted my interview style to accommodate their needs and met with them face-to-face. This eliminated the stress of connecting virtually and allowed them to have a more active role in the co-design process. Seeing how I use the technology to create their DTP was not only educational for them, but we were able to finalize the DTP prototype more quickly. This created a more personable experience for both the researcher and participant leading to a more relaxing environment. Meeting the participant on campus next to the studio gave me the ability to show what happens behind the scenes when producing the digital textile print and share fabrication options. This created a fun and creative environment to work in.

Some other participants also expressed they would have preferred a face-to-face interaction. Participants did say they appreciated meeting virtually, because it provided a simulated experience of meeting face-to-face and they were able to see changes occur virtually. It should be noted that meeting virtual did not allow as fluid of an exchange in the co-creation process when flipping back and forth between screens and programs to apply changes. However, meeting with participants over Zoom and or the phone did allow me to include participants from all over the country. In the future if I co-design virtually I will be more prepared on how to handle some of the challenges. This will

include making it easy to make quick edits within my file and having different versions available to show participants during meeting versus waiting and losing synergy.

### ***Future Research***

Although this study does not specifically explore why some breast cancer survivors are more likely to wear breast cancer related apparel, it would be interesting for future exploration. Providing additional understanding about the role breast cancer related apparel plays in identity expression. It was found in this study that most participants did not feel it was necessary to express their breast cancer group membership through their DTP design. However, it did not stop them from wearing other breast cancer related apparel occasionally to show their affiliation and support for breast cancer. This study did not go into detail about why some breast cancer survivors were more opposed than others in expressing their journey through DTP. However, it was concluded that for many participants, this was a part of their private identity that they did not feel comfortable publicly sharing. Future studies may benefit from exploring at what point, if any, are breast cancer survivors more likely to share their experiences with others.

Although this study explored how breast cancer survivors express their identity through DTP. For one of the survivors who was just finishing her breast cancer reconstruction, it seemed to cause her to focus more heavily on her breast cancer experience through her DTP. It may be because her experience was still fresh and length of time from diagnosis and/or treatment may impact this.

Much like other forms of creative art therapy, I think it is worth exploring whether using DTP in a co-design process can be used as an art and/or healing therapy for patients. This study's findings show that participants expressing themselves through

DTP was therapeutic. These findings lead me to think that there may be other beneficial outcomes for patients who are in the process of healing. For example, one of the participants who interacted with their physician during the wear trial said the physician commented that they wish all breast cancer patients had this experience at the end of their course of treatment. Another physician's assessment of this participant was that she had a more positive attitude toward the breast cancer experience that the physician thought that this might be attributed to the scarf process and aiding the participant in finding closure. The process allowed participants to engage in creation with low stress as the researcher provided them with an object they could wear for comfort. It also allowed participants to communicate with others and build stronger relationships, and it also helped to educate the people they interacted with about the participant's breast cancer journey.

Throughout the evaluation process there appeared to be a correlation between the participants favorite style of art and their chosen DTP. It is worth exploring how other forms of visual imagery influence what is worn on the body. Although, this question was helpful to have in the participants survey it was not fully explored as to the connection between the two.

I think it is worth investigating other forms of co-design methods and explore which can be most effective. Participants in this study relied on my interpretation of the information they gave me. Depending on how much and quality of information that was given to me some prototypes were more appealing to the participant than others. This could be due to the quality of information provided and or designers interpretation. All participants said they liked being surprised by the first round of prototypes and what I did

with their images. I wonder if perhaps they may find being more involved in the design process at the beginning more fulfilling. I think a lot can be learned about how we engage the co-designer in the process. The methods used for this study created low stress on the co-designers' part due to their limited digital textile print knowledge for some.

## **Research Reflection**

### ***Co-Design Process***

A lot of considerations were made to make the co-design process as fluid as possible for the co-designer. Without knowing some apparel preferences and information about why their images were important to them, I would not have been able to successfully trigger emotional responses from participants regarding their DTP prototype designs. This information was needed for me to understand what was special to them. The information provided informed me what I chose to highlight so that it matched the same emotion expressed in the images, how I integrated their images, the modifications made, and the complementary elements I included into the design. The views expressed during the image selection process helped to inform the story and or message relayed in their DTP design. The curation and descriptions of images help to inform me of which stories were more important to them.

Participants were surprised at how the images complemented each other in the DTP designs. When submitting the images most participants did not realize the correlation of stories being told through their imagery. After analyzing this data, it was easy to find themes within the images submitted which helped me to determine which images to place together within a DTP design. The images selected also helped me to

create a stronger connection with the participants and break the ice during the first interview.

Participants liked being surprised by the results of the DTP prototypes. As mentioned above this created less stress and time on the part of the co-designer. Providing a starting point to launch from served as a conversation starter. It allowed me to get to know the participant's likes and dislikes. I often wondered though if the outcome would have been the same if the participants would have been involved in the first round of prototypes. I wondered if my initial DTP designs may have persuaded their decision making. I also think if I had involved participants more at the beginning, they may have lost interest or due to time constraints been less likely to participate. I think for some individuals who have never seen imagery be used to create print designs this made it easier to be introduced to its capabilities.

The wear trial was beneficial to see if their prediction of wearability changed during the wear trial test. The exit interview captured a larger scope of the reflection process. It is one thing to see the DTP virtually it is another to see it printed onto fabric and have a chance to wear it. The exit interview allowed me to capture what they value in their DTP and what they thought their DTP said about them. Additionally, I gained greater insight about what they liked about the co-design process and what changes they recommend. The exit interview served was a great opportunity for reflection. Participants expressed how much they liked being involved in the design process and how it helped connect them more to their DTP.

### *Reflection on Study Design*

The interview protocol was edited several times throughout the study design and during the pilot study. However, I think the questions can be decreased further. I would modify how I ask questions regarding tough concepts like symbolic values in dress. This was one of the most challenging concepts for participants to understand. The average person does not think about their symbolic values in their dress, and this became stressful for them to answer. My solution to this would be to ask a more simplified question like: What do you think this DTP says about you?. The interview is meant to be conversational and asking complicated questions takes the conversational element out of it.

During my data analysis I realized how important it is to be an active listener. There were times when participants repeated themselves because I had already asked a similar question. Now looking back on the order of questions I wish I had asked “What does your print say about you?” at the time of DTP evaluation. This helps to inform how they’re examining their self-image during the reflection stage. The values expressed in this response also help to inform what is important to them and how their reflection triggers emotions related to these values.

Overall, each stage of the study helped to inform the next and it provided me the opportunity to have follow up conversations with participants regarding unexpected findings in each stage. This gave me the opportunity to adjust as I went. For example, I thought the survey would have answered my research question regarding the role digital textile prints play in female breast cancer survivors’ identity expression. There was not enough conclusive evidence to determine what role DTP plays in breast cancer survivors’ identity expression. This would later be revealed in their evaluation of DTP prototypes as

I learned about what they are willing to share with others. I am not sure if I could have predicted this or if I would have changed anything now looking back on it.

It was important for me to protect the participants time and make the process easy and enjoyable to participate in. Much of their time at the beginning was spent curating images for inclusion in their DTP designs and reflecting in their journal. However, the first round of journal entries was not as successfully completed as the second. I think this was due to them getting overwhelmed by beginning instructions. Most thought after their image submission they were done and had forgotten about the journal question.

I was surprised how emotionally invested I became as a researcher in designing a product that would accurately tell participants' stories. The most beneficial part of co-creating a design was the ability to help them creatively communicate their story through their DTP design. Their stories touched me and hearing about their wear trial experiences was very rewarding. I felt that I had a hand in creating space for these reflection/healing moments to occur. This research pushed past the superficial and focused on the emotional connection we have with what we wear on our bodies. Having had conducted research in the past without involving participants in the co-design process and now including them, this is by far the most personally rewarding research I have conducted.

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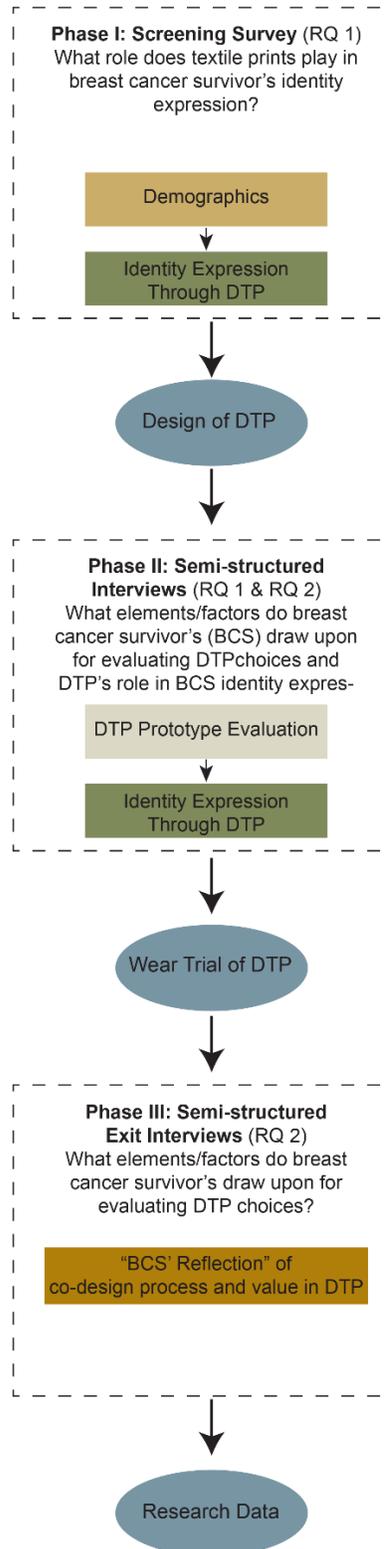
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## APPENDIX A

### RESEARCH STUDY DESIGN



## APPENDIX B

### INTERVIEW PROTOCOL

#### Protocol 1: Screening Survey (Phase I)

Participants were provided a consent waiver and asked to answer the following questions in the Qualtrics survey link provided. The questions pertained to general demographics, participant appearance criteria, and research questions RQ1 and RQ2 outlined in the table below.

Relationship of Theory and Research Questions to Interview Questions	
Theory	Research Questions
<p><b>Emotional Design Theory:</b> <i>Visceral</i>, appearance of the product (perceptually induced)</p> <p><b>Emotional Design Theory:</b> <i>Behavioral</i>, the user expectation of performance, utility, functionality of the product (expectation-induced)</p> <p><b>Emotional Design Theory:</b> <i>Reflective</i>, refers to the prestige or value the user places on the product. The reflective level also monitors, reflects upon, and attempts to bias the behavioral level (intellectually induced)</p> <p><b>PPSS Theory:</b> <i>Public Self</i>, is the part of a person that is available for others to see.</p> <p><b>PPSS Theory:</b> <i>Private Self</i>, is that which is presented to friends, family, or other intimate relationships.</p> <p><b>PPSS Theory:</b> <i>Secret Self</i>, the secret self is that which is hidden from others.</p>	<p><b>RQ1:</b> What role does textile prints play in breast cancer survivor's identity?</p> <p><b>RQ2:</b> What elements/factors do breast cancer survivor's draw upon for evaluating textile print design choices?</p>

#### Demographics:

- D1: Do you identify as female (yes, no, other)? - If participants answer no they will be taken to the end of the survey.

- D2: Are you still in breast cancer treatment (yes/no)? - If participants answer no they will be taken to the end of the survey.
- D3: Consent Form – additional consent was obtained during the exit interview once DTP was finalized.
  - I consent, begin the study
  - I do not consent, I do not wish to participate
  - Yes, I consent to a photo of my digital textile printed scarf to be included in published research if NO identifies are used.
  - Yes, I consent to a photo of my digital textile printed scarf if identifies are used in published research.
  - No, I do not consent to a photo of my digital textile printed scarf to be used in published research.
- D4: What is your name (first & last)?
- D5: What is your best email, phone number, and home address to reach you at and send the scarf to?
- D6: What is your age?
- D7: What city/state do you live in?
- D8: What is your race?
  - American Indian or Alaska Native
  - Asian
  - Black or African American
  - Native Hawaiian or Other Pacific Islander
  - White/Caucasian
  - Hispanic American
  - Multiple ethnicity/others (please specify)
- D9: What is your highest degree completed?
  - No High School
  - Graduated from High School
  - Associates Degree
  - Bachelors Degree
  - Masters Degree
  - Doctorate Degree
  - Other (please specify)
- D10: Select the answer that best describes your marital status
  - Single/Never Married
  - Domestic Partnership
  - Married
  - Divorced
  - Widowed
- D11: What is your current occupation?

- D12: What if any religion or spirituality do you practice?
- D13: Do you have children (yes, no)?
- D14: How many children do you have?
- D15: What stage of breast cancer were you diagnosed with?
  - Stage 0
  - Stage 1
  - Stage 2
  - Stage 3
  - Stage 4
- D16: Please select the following courses of treatment you have undergone?
  - Chemotherapy
  - Radiation therapy
  - Hormone therapy
  - Immunotherapy
  - Lumpectomy
  - Single Mastectomy
  - Double Mastectomy
  - other:\_\_\_\_\_)?
- D17: How long from breast cancer diagnoses to remission? With remission meaning the disappearance of signs and symptoms of cancer.
- D 18: **Asked at end of data collection.** How many years has it been since your breast cancer diagnosis?

**Identity and Textile Prints (RQ1 & RQ2, Visceral, PPSS):**

- ITP1: Have you ever had a customized textile print created for yourself? If yes, what did you have customized?
- ITP2: Are you interested in having a textile print design customized?
  - Definitely yes
  - Probably yes
  - Might or might not
  - Probably not
  - Definitely not

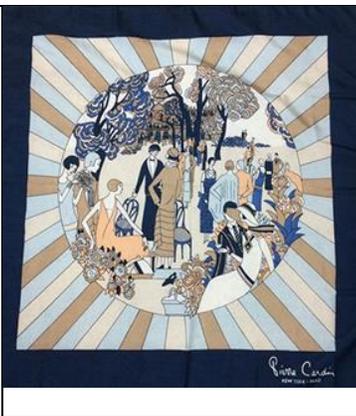
- ITP3: What 1-3 images best represent your clothing style? Please rank your selection with 1 being most liked in the text box.

Style Name	Photo Example	Style Name	Photo Example
Sporty		Bohemian	
Grunge		Preppy	
Punk		Streetwear/Hip Hop	
Classic		Casual	
Retro/Vintage		Tomboy/Gender Neutral	

Western/Cowgirl		Modern/Contemporary	
Other (please specify)			

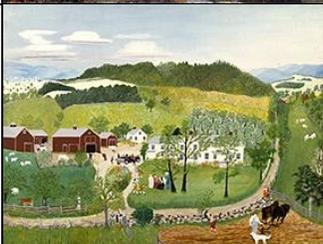
- ITP4: What are your favorite color/s (Red, Blue, Green, Purple, Orange, Yellow, Gray, Pink, Brown, Black, white, other)? You may specify a specific color if you have one in mind (e.g., chartreuses, pewter, periwinkle, merlot, etc.)
- ITP5: What are 1-3 style textile patterns do you like most? Please rank your selection with 1 being most liked in the text box.

<b>Textile Name and Description</b>	<b>Photo Example</b>	<b>Textile Name and Description</b>	<b>Photo Example</b>
<p><i>Florals</i> - Can Include leaves, thorns, twigs, and other plants figures, while coming in a variety of styles, layouts, and effects.</p>		<p><i>Geometrics</i> - Use a variety of shapes, objects, and pattern designs.</p>	
<p><i>Conversational</i> - Including but not limited to prints with circus/clowns, fans, hearts, buildings, animals, knots, hunting, military, sports, nautical, zodiac, and etc.</p>		<p><i>Ethnic</i> - Including but not limited to African, American Indian, Greek, Asian, Persian, Tie-Dye, and etc.</p>	

<p><i>Art Movements/Period Styles - Including but not limited to Art Deco, Graffiti, Punk, Psychedelic, Medieval, Neoclassical, Modernism, and etc.</i></p>		<p><i>Other (please Specify)</i></p>	
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- ITP6: What are 1-3 styles of art that you like most? Please rank your selection with 1 being most liked in the text box.

Art Style Name	Photo Example	Art Style Name	Photo Example
Abstract		Modernism	
Realism		Surrealism	
Pop Art		Impressionism	

Expressionism		Cubism	
Photorealism		Contemporary	
Romanticism		Symbolism	
Folk Art		Other (please specify)	

**Value and Textile Prints (RQ1 & RQ2, visceral/behavioral/reflective, PPSS):**

Symbolic values are human's emotional judgement of a product based on the socio-cultural environment. The wearer can express their symbolic values through textile print designs. However, interpretation of these values lies within the observer. Symbolic values could include beliefs, attitude, behavior, motivations, perception, group membership, self-esteem, decoration, respectability, fashion, or other needs.

- VTP1(behavioral/PPSS): Do you like to wear patterns/prints on your apparel related products?
  - Definitely yes
  - Probably yes
  - Might or might not
  - Probably not
  - Definitely not

- VTP2(behavioral/PPSS): Roughly what percent of your wardrobe has a pattern/print on it?
  - 5% or Less
  - 10%
  - 20%
  - 30%
  - 40%
  - 50% or More
- VTP3 (behavioral/PPSS): How often do you wear apparel related products that convey a message/saying (e.g., Keep Calm and Carry On), descriptive words (e.g., Glamorous), or image/graphic (e.g., Star Wars, Starry Night, etc.)?
  - None
  - 1-2 times a week
  - 3-5 times a week
  - 6-7 times a week
- VTP4 (behavioral/reflective): Before purchasing a garment with a pattern/print which factors do you value most? Please rank these in order of importance, 1 being very important to 6 not important at all.
  - Respectability
  - Beliefs
  - Self-esteem
  - Group Membership
  - Perception/Status
  - Fashion/Decoration
  - Other, please specify
- VTP5 (reflective/PPSS): When thinking about the patterns/prints you wear what do these factors mean to you? e.g., Self-esteem: people will clearly see my confidence/notice me in a positive way; Group Membership: people will relate to me; Respectability: people will accept me; etc.
  - Beliefs
  - Perception/Status
  - Group Membership
  - Self-esteem
  - Respectability
  - Fashion/Decoration
  - Other, please specify
- VTP6 (visceral): Before you purchase a garment with a pattern/print what factors do you consider? Please rank these in order of importance, 1 being very important to 6 not important at all.
  - Color

- Imagery or text used in the print
- Style of Print
- Texture
- Scale of motif
- Care instructions

### **Between Protocol 1 & 2: Photograph and Journal Instructions**

Participants were given instructions about photographs needed for prototype development and questions to reflect on in their journal entries as outlined below. Participants were given two weeks from the time of survey completion to submit their photographs.

#### **Photograph Instructions:**

Next Steps (Photographs) - Please complete the following

To begin the digital textile print creation process I ask that you select 5-7 original photos you have taken that you would like to see included in your scarf's digital textile print design. The photos selected are up to your discretion and can range from people, places, events, landscapes/nature, pictures of art you like, etc. If you want to take photos specifically for your scarf you can capture objects with interesting colors, shapes, textures, light, lines, etc. Using photographic images allows for details to be captured like water droplets that otherwise is hard to capture by drawing.

Please email me ([nicole.eckerson@mail.missouri.edu](mailto:nicole.eckerson@mail.missouri.edu)) your photos and responses to the following questions by Monday, February 7<sup>th</sup>, 2022. You can either email original digital .jpeg files or scanned .jpeg or .pdf copies of photos.

When thinking about the photos you selected for your digital textile print, what specifically was it about the photos that made you select them. Please answer the following questions in relation to the photos selected.

- Tell me about the photos you selected, why did you choose these for your print?
- What meaning do these photos have to you?
  - What do you like most about the photo?
  - What do you like least about the photo?
- Do these photos remind you of a person, place, time, or event in your life? If so explain?
- Do you have any considerations you want me to consider for the photos provided when developing your digital textile print designs?

Once I receive your photos and responses to the above questions, I will create 2-3 digital textile print design options for us to discuss at our first meeting. What is your availability for an approximately 45minute meeting the week of February 14th? I will send you a Zoom meeting link once a meeting date and time has been arranged.

### Journal Entry 1:

As a participant in this study, you will be asked to keep a reflective journal and respond to questions given. The journal can be electronic or hardy copy, feel free to be creative with how you respond it can include text, images, collage, drawings, etc. I will ask you to share this entry at our first interview.

Think about your favorite pattern/print on a garment in your closet. Now think about one pattern/print you love for its symbolic values. Symbolic values are human's emotional judgement of a product based on the socio-cultural environment. The wearer can express their symbolic values through textile print designs and can include beliefs, attitude, behavior, motivations, perceptions, group membership, self-esteem, decoration, receptibility, fashion, or other needs.

- What is your favorite pattern/print on an apparel related item you own and why?
- In the pattern/print chosen which symbolic value/s is/are best represented?

### Protocol 2: Identity Expression and DTP Prototype Evaluation (Phase II)

Participants participated in a Semi-structured interviews (Zoom, phone, or face-to-face) within two weeks of photograph submission. With each participant to evaluate how breast cancer survivors' express their identity through textile print designs and what elements/factors they draw upon for evaluating textile print design choices. Addressing both RQ1 and RQ2.

Relationship of Theory and Research Questions to Interview Questions	
Theory	Research Questions
<p><b>Emotional Design Theory:</b> <i>Visceral</i>, appearance of the product (perceptually induced)</p> <p><b>Emotional Design Theory:</b> <i>Behavioral</i>, the user expectation of performance, utility,</p>	<p><b>RQ1:</b> What role does textile prints play in breast cancer survivor's identity?</p> <p><b>RQ2:</b> What elements/factors do breast cancer survivor's draw upon for evaluating textile print design choices?</p>

<p>functionality of the product (expectation-induced)</p> <p><b>Emotional Design Theory:</b> <i>Reflective</i>, refers to the prestige or value the user places on the product. The reflective level also monitors, reflects upon, and attempts to bias the behavioral level (intellectually induced)</p> <p><b>PPSS Theory:</b> <i>Public Self</i>, is the part of a person that is available for others to see.</p> <p><b>PPSS Theory:</b> <i>Private Self</i>, is that which is presented to friends, family, or other intimate relationships.</p> <p><b>PPSS Theory:</b> <i>Secret Self</i>, the secret self is that which is hidden from others.</p>	
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**Breast Cancer Survivor Profile (RQ1 & RQ2):** Reviewed appearance preference data collected from survey with participants.

- (reflective) Is there anything that you believe is not an accurate reflection on your profile? What? and What would you like it corrected to?

**Identity and Textile Prints (RQ1 & RQ2):** When thinking about your personal style and the photos selected, please answer the following questions regarding your design needs.

- ITP7 (reflective/PPSS): Since your breast cancer diagnosis have you experienced a change in your apparel preferences? If so, how? Why? If not, why do you think this is?
- ITP8 (reflective/PPSS): What do you want your pattern/print to say about you?
- PE9 (reflective/PPSS): How do these photos represent your values (beliefs, attitude, behavior, motivations, perception, group membership, self-esteem, decoration, receptibility, fashion)?
- ITP10 (reflective/PPSS): Is it important that you demonstrate your group membership of being a breast cancer survivor through your textile print design?

**Print Evaluation (RQ1 & RQ2):** This is a continuation of the initial semi-structured interview. This part of the interview focused on how breast cancer survivors evaluate textile print designs. The participants were shown 3-5 digital textile print design choices. Participants responded to the same set of questions for each design given. **As you are looking at the digital textile print design, please articulate any [evaluation criteria] you are thinking about when responding.**

- PE1(visceral/reflective): [Show Prototype] How does this print make you feel (e.g., excited, pleasant, calm, neutral, unpleasant)?
  - How did you come to that conclusion/or evaluate the print?
- PE2 (visceral): What do you notice first? and Why?
- PE3 (behavioral/reflective/PPSS): Do you feel this print matches your personality? How? Why Not?
  - How did you come to that conclusion/or evaluate the print?
- PE4 (visceral/behavioral/reflective/PPSS): What do you like about this print? And Why?
  - What do you see that made you come to that conclusion/or evaluate the print?
- PE5 (visceral/behavioral/reflective/PPSS): What don't you like about this print? And why?
  - What do you see that made you come to that conclusion/or evaluate the print?
- PE6 (behavioral/PPSS): Would you wear this print on a scarf? Why or Why Not?
  - How did you come to that conclusion/or evaluate the print?

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**Cycle Through Questions 1- 6 for each Prototype**

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- PE7 (visceral/behavioral/reflective/PPSS): Out of the print design choices place them in order of most to least favorite with 1 being most favorable.
- PE8 (visceral/behavioral/reflective/PPSS): If you do not like any of the prints, please identify what you would change? Explain?
- PE9 (visceral/behavioral/reflective/PPSS): Do you have any other criteria (relating to aesthetic or performance expectations) not being met in the print selected?

### **Between Protocol 2 & 3: Wear Trial & Journal Instructions**

Participants were given instructions about the wear trial and questions to reflect on in their journal entries as outlined below. Participants were given three weeks to wear trial test from the time they received their scarf.

#### **Wear Trial Instructions:**

Now that your custom digital textile printed scarf is completed you will have 3 weeks from the date the scarf is received to wear the scarf 2-3 times and reflect upon your experiences in your journal. You can opt to wear the scarf more if you wish to do so. How you choose to wear the scarf and for how long it is worn is at your discretion.

### Journal Entry 2:

Please record date worn, where you wore it, how you wore it, and how long you wore it. How you wore it can be documented by photograph or in writing. When thinking about your experience wearing the custom digital textile printed scarf, please respond to the following questions regarding your wear trial experiences.

- How did this scarf make you feel?
- Did you feel comfortable wearing it in public? Why? or Why Not?
- How did your experience wearing the scarf impact you?
- Did you talk to others about your scarf? If so, what was said?
- How did people's reactions make you feel?
- Did you experience any surprises while wearing the scarf?

Journal entries can be emailed to me a couple days before our last scheduled interview at (XXX). Please identify a day and time the week of April 25<sup>th</sup>, 2022, that you can meet for a 45-minute interview. Once the meeting is arranged, I will email you a Zoom meeting invite.

### Protocol 3: Users' Perception of Co-design and Value in DTP (Phase III)

After the wear trial testing participants participated in a semi-structured interview (Zoom, phone, or face-to-face) assessing their reflective experience of the role DTP plays in breast cancer survivor's values associated with DTP and Co-design process.

Relationship of Theory and Research Questions to Interview Questions	
Theory	Research Questions
<p><b>Emotional Design Theory:</b> <i>Visceral</i>, appearance of the product (perceptually induced)</p> <p><b>Emotional Design Theory:</b> <i>Behavioral</i>, the user expectation of performance, utility, functionality of the product (expectation-induced)</p> <p><b>Emotional Design Theory:</b> <i>Reflective</i>, refers to the prestige or value the user places on the product. The reflective level also monitors,</p>	<p><b>RQ2:</b> What elements/factors do breast cancer survivor's draw upon for evaluating textile print design choices?</p>

<p>reflects upon, and attempts to bias the behavioral level (intellectually induced)</p> <ul style="list-style-type: none"> <li>● Emotions inherently reside in the user of the product rather than in the product itself.</li> <li>● The emotions the user has with their interaction with the product are not the same as intended by the designer.</li> <li>● The user interactions with the product are unique to the individual and can have a direct impact on the users' product perception.</li> <li>● Designers have the most indirect control over the users' visceral and behavioral reactions rather than the reflective reactions.</li> <li>● Use of the product is beyond the designer's control.</li> <li>● Users' emotions can occur by accident when they are interacting with a product or can occur by design through a designer planned intended emotional response for the user as discussed above.</li> </ul> <p><b>PPSS Theory: <i>Public Self</i></b>, is the part of a person that is available for others to see.</p> <p><b>PPSS Theory: <i>Private Self</i></b>, is that which is presented to friends, family, or other intimate relationships.</p> <p><b>PPSS Theory: <i>Secret Self</i></b>, the secret self is that which is hidden from others.</p> <p><b>User Centered Design (UCD)/Co-design:</b> Co-design is defined as the creativity of designers and people not trained in design working together in the design development process.</p>	
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### Co-Design (RQ2, behavioral, reflective):

- CD 1: How did participating in the co-design process impact you?
  - UP1a: What did you enjoy about co-designing your print?
  - UP1b: What did you not enjoy about the co-designing your print?
- CD2: Do you feel that expressing yourself through an exclusive textile print has increased or impacted you wearing the scarf? Explain.
- CD3: Did your experience wearing the scarf impact you sharing your breast cancer experience with others? If so, how?

**Value and Textile Prints (RQ2, behavioral, reflective):**

- VTP7: What do you think this textile print design says about you?
  - VTP7a: How does the print on the scarf represent or meet your symbolic value/s (beliefs, attitude, behavior, motivations, perception, group membership, self-esteem, decoration, receptibility, fashion)?
- VTP8: Does having a customized print allow you to better express your values, than prior to going through this experience?
- VTP9: On a scale of 1-10, with 1 being the lowest and 10 being the highest how would you rate the value of this scarf?
- VTP10: What do you plan to do with this scarf after the study (discard it, donate it, keep it, gift it, pass it down, etc.)?
  - VTP10a: Did having a customize print impact what you plan to do with it?

## APPENDIX C

### RECRUITMENT EMAIL

Dear \*Participant's Name\*,

I am a Ph.D. student studying Textile and Apparel Management at the University of Missouri. I am currently conducting a research project on exploring how imagery used in digital textile prints impacts female breast cancer survivor's symbolic value placed on the printed fabric.

I am looking for participants 18 years of age or older that are female breast cancer survivors who are in remission and are considered cancer free. Participants will take a brief survey and be interviewed three times throughout the study about their experiences and preferences regarding digital textile prints over Zoom at a time convenient to them. The interviews will take roughly 45minutes. The information from these interviews will be used to develop custom digital textile printed scarves from photos participants provide. Participants will keep the custom scarves designed.

If you would like to be a participant in this research or know someone who may be interested to participate, please take the following survey at \*survey link\*. If you meet the qualification criteria you will be asked to complete the full survey at the end of the survey please read, sign, scan, and email back to me the attached consent form. Once I receive the consent form from you, I will email you to schedule your Zoom interview at your convenience.

If you have questions about the consent form, please contact me at the number or email below.

Thank you for your time and interest in this research!

Nicole Eckerson

Principle-Investigator, PhD Student

University of Missouri Textile and Apparel Management

Phone: 612-251-9754

Email: ne647@mail.missouri.edu

## APPENDIX D

### CONSENT WITH WAIVER OF DOCUMENTATION

**Project Title:** Exploring the impact of digital textile prints on identity expression in women breast cancer survivors

**Principal Investigator:** Nicole Eckerson

**IRB Number:** 2056386

Please ask the investigator or the study staff to explain any words or information that you do not clearly understand.

#### **DESCRIPTION AND EXPLANATION OF PROCEDURES:**

The primary goal of this research is to gain detailed information on how imagery used in digital textile prints impacts female breast cancer survivor's symbolic value placed on the printed fabric. While exploring what elements and factors breast cancer survivors draw upon for evaluating digital textile print design choices. The outcome of this study will include a custom designed digital textile printed scarf, that the Designer/Researcher creates from the information gathered from the participant and their original photographs. This interactive study will be conducted in three phases. With Phase I: Survey, Phase II: DTP Prototype Evaluation, and Phase III: Users' Perception of Symbolic Value in DTP. Each of the three interviews should last approximately 45 minutes. Participants in this study will be asked to respond to three to four reflective journal entries with 1-3 questions in each journal entry throughout the study. Each journal entry should approximately take about 15minutes to respond to. The participant will share their journal entries with the Researcher.

To address this study's objectives, I would like to have you complete a brief survey and arrange a virtual Zoom interview with you, which should take approximately 45 minutes. The objective of the survey in Phase I of this study is to explore how your breast cancer, values, and design requirements contribute to your expression in digital textile prints. Preparatory instructions for the first interview will be provided at the end of the survey.

In Phase II: DTP Prototype Evaluation of this study participants will conduct a virtual Zoom interview approximately 45 minutes. The aim of Phase II of this study focuses on gaining deeper insights into what elements/factors do breast cancer survivors draw upon for evaluating digital textile print design choices. Participants will evaluate the first prototypes of their custom designed digital textile prints. The design will be revised until approved by participant, communication regarding revisions will occur through email or Zoom depending on participant's preference.

In between Phase II and III of this study participants will be asked to wear trial test their scarves 2-3 times within a three-week period. Participants can opt to wear their scarf more if they wish to do so. How the scarf is worn and for how long it is worn is at the

discretion of the participant. They will record how they wore the scarf and for how long they wore the scarf in their reflective journal entries. After which in Phase III: Users' Perception of Symbolic Value in DTP of this study participants will conduct a virtual Zoom interview approximately 45minutes. The objective of the last interview is to gain deeper insights regarding breast cancer survivors' perception of symbolic values in their custom designed scarves.

Your participation in this research is completely voluntary. If you agree to be part of this study, an audio recording will be conducted of the interview. Participant's names and identities will not be linked to audio interview recordings to ensure privacy.

If you permit, I will use a photo of your digital textile printed scarf for possible inclusion in research publications. If there are participant identifiers in the digital textile printed scarf that you do not want made public, you have the right to waive consent to its release. All files associated with the research will be stored on password-protected drives in locked offices. Both the audio files and photographs will be stored in digital format. By signing this consent form, you are giving the researchers' permission to audio tape your voice and to use your voice and likeness in photograph(s)/video for publication for the above titled approved research and future publications relating to the above titled research. Your name will not be used in any publication.

**CONFIDENTIALITY:**

Data will be saved and kept strictly confidential. Any electronic files will be saved with numeric codes, with no personal identifiers. Throughout the procedures, if you feel uncomfortable with any questions or experiences, you may stop participation at any time. Finally, only the researchers will have access to the data, and the aggregated data will be analyzed and shared for publication. You will be assigned a pseudonym protect your confidentiality. The data will be kept for seven years after the study has been completed.

**COMPENSATION:**

You will receive a non-monetary gift of your custom digital textile printed scarf.

**RISKS AND BENEFITS:**

There are no perceived immediate risks of participating in this study. Digital textile prints and interview data is currently being used to improve the design of apparel, which in turn helps consumers and the apparel industry.

**PARTICIPATION:**

You are free to refuse to participate or to withdraw your consent to participate in this research at any time without penalty or prejudice; your participation is entirely voluntary. Your privacy will be protected because you will not be identified by name as a participant in this project. All interviews will be kept strictly confidential. If you have any questions concerning your rights as a participant, you may contact the University of

Missouri Campus Institutional Review Board at 573-882-3181. Questions or concerns regarding this study may be directed to the researchers; Nicole Eckerson at 612-251-9754 or by e-mail ne647@mail.missouri.edu or the advisor, Dr. Kristen Morris at by email kristen.morris@colostate.edu

I appreciate your willingness to be a participant, and I thank you for your time.

**CONSENT:**

- I agree to participate in this research study
- I do NOT agree to participate in this research study

**ADDITIONAL CONSENT:**

**Photo Consent**

- Yes, I consent to a photo of my digital textile printed scarf to be included in published research if NO identifies are used.
- Yes, I consent to a photo of my digital textile printed scarf if identifies are used in published research.
- No, I do not consent to a photo of my digital textile printed scarf to be used in published research.

## VITA

Nicole was born in Pueblo, Colorado and grew up in Eyota, Minnesota. She attended Dover Eyota High School in Eyota, Minnesota until the tenth grade. After which she spent the remaining two years of high school in the post-secondary program at Rochester Community and Technical College (RCTC) where she earned an A.S. degree in Retail Merchandising, Interior Decorating Option. While a student at RCTC she was recruited to be a Merchandising Intern/ Sales Associate at Lerner New York Co. in Rochester, Minnesota. She then transferred to Iowa State University where she earned a B.S. in Apparel Merchandising, Design and Production with a double primary emphasis in Creative Design and Merchandising and a minor in Business Administration.

After graduation she worked as Technical Associate Designer for Kuhlman Company in Minneapolis, Minnesota. Following this position, she worked as a Freelance Designer for Wilsons Leather in Brooklyn Park, Minnesota. She then moved to Kalamazoo, Michigan where she earned her M.A. in textile and apparel studies at Western Michigan University. Her thesis focused on creating original line of garments using couture sewing methods. During this time, she worked in a variety of roles as a Graduate Teaching Assistant, Adjunct Instructor, and full-time Product Development Instructor. In addition, she worked as Product Development Graduate Intern for Meijer in Grand Rapids, Michigan. Further, she also worked as a freelance design consultant for Tekna in Kalamazoo, Michigan.

She then moved to Columbia, Missouri to earn her PhD in textile and apparel management at the University of Missouri where her research focused on exploring the impact of digital textile prints on identity expression in women breast cancer survivors.

While at the University of Missouri she was a full-time Graduate Teaching Assistant/Instructor. Further she also served as the President of the Graduate Student Association of Textile and Apparel Management. She is dedicated to teaching the next generation of fashion students how to provide innovative design solutions that meet users needs in the apparel industry, while considering marginalized populations, like breast cancer survivors.