2010

Metalling with Fibers: A Design Series Exploring the Reuse of Metal Findings Through the Use of Technology

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When analyzing socially responsible practices along the supply-chain of apparel production, there has not been an emphasis on the purchase of findings used in production of clothing and how surplus items are used or discarded. Hawley[1] describes the mechanical sorting of findings to assist in the post-consumer recycling of apparel to aid in reclaiming fiber from products. Her research raised the following questions for me as a designer, fiber artist and researcher: 1) What happens to these findings after they are removed from the garment? 3) Is it possible to use these items in wearable or fiber art projects? 4) Where are additional sources for obtaining or reclaiming surplus or discarded findings?

During the early years of my career I worked for a couple of jean manufacturers. One of the manufacturers at that time completed the majority of their production in the United States. As with many apparel companies, there were abundance of findings purchased or provided by vendors, not used in production. Often these items are given or sold to employees at a discount price instead of discarding them.

In my wearable/fiber art series, *Metalling with Fibers*, I explore the reuse of metal findings (i.e. buckles, washers, zipper pulls) in textile arts designed with computer technologies. During a visit to Colorado as a visiting professor, I had a conversation with my mentor Dr. Robert Hillestad[2] concerning what I could do with the abundance of findings I had accumulated. Knowing my background as a knitter, Robert suggested that I string them onto yarn and knit with them. He even suggested the play on words for the title of the series, *Metalling with Fibers*. Robert's suggestions spurred my two year exploration with materials and techniques that resulted in a series of small scale wall hangings composed of yarn and metal findings. Sometimes it takes conversations with a trustworthy friend to help one make obvious connections. I am thankful to Robert for helping me find a new path for my creative scholarship and artistry.

In this paper I will describe my design process for *Metalling with Fibers XXX: A Study in Geometry*, provide an overview of the processes used for various other pieces of wearable and fiber art I have created through the reuse of metal, suggest methods for integrating findings into textile art, provide strategies for obtaining surplus findings, and propose a model for metal findings reuse in traditional textile arts (knitting, crocheting, and embroidery). I will also share examples of using computer aided design technologies in the pieces created and exploration.

Discovering a socially responsible means to deal with surplus supplies that are a by-product of mass produced apparel has evolved into an important aspect of my creative scholarship. Employing creativity, good design, and aesthetics to create fiber and wearable art, is a means to re-purpose discarded apparel components that would potentially end up in a landfill. The following process model graphically illustrates the stages of my design process for this garment: 1) Design Objectives and Inspiration, 2) Garment Creation, and 3) Evaluation. (Fig. 1)

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[1] Jana Hawley, "Digging for Diamonds: A Conceptual Framework for Understanding Reclaimed Textile Products," *Clothing and Textiles Research Journal* 24 (2006): 262-275.
[2] Hillestad, Robert Christian. *Robert Hillestad a Textiles Journey* Lincoln, Nebraska: Friends of the Robert Hillestad Textiles Gallery, 2008.

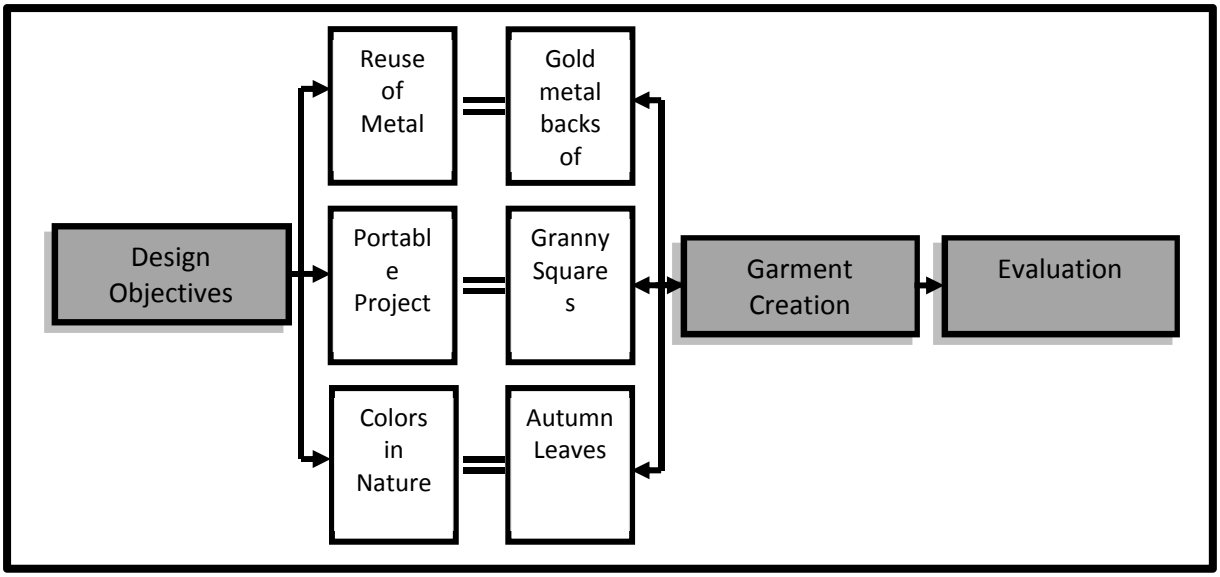

Figure 1. *Metalling with Fibers XXX: A Study in Geometry Process Model.*

My design objectives for creating this dress were threefold: 1) reuse metal components in a knitted garment, 2) to have a knitted project in which the majority of it was portable and easy to take while traveling, and 3) create a garment that was inspired by the colors in nature. The following will detail how the objectives were met through the design process and development of the product, plus the media I employed.

To meet the first objective, the reuse of metal, I decided to use metal backs of decorative bar studs as the metal component of this project. The physical characteristics of the materials used in the garment had to be taken into consideration while designing and knitting the garment. For example, the inclusion of metal adds a significant amount of weight to the finished garment, elongates the fibers and affects the elasticity of the yarns. To compensate for these problems, I decided to place the metal only in the shoulder and upper bodice of the garment, to relieve potential stress on the yarns and minimize the stretch of the dress.

To have a knitted project that was conducive to travelling by car, airplane, and subway, was essential; since I had travel plans during the creation of the project. A simple knitting technique to create small inconspicuous components allowed me to have a portable project. The knitting technique had to be one that did not require extensive shaping and concentration. It was decided to explore the creation of geometric shapes such as squares and rectangles. Portable knitting projects have been a desire of knitters for sometime, as evident in the commercial availability of knitting supplies and books that foster portable projects. For example, Vogue Knitting[3] has the popular "Knitting on the Go" series of books which focus on portable accessory apparel and home accessories projects.

Prototypes generally are not developed with hand knits, only a sample swatch to test the gauge. Gauge is the "number or stitches and rows per inch or centimeter in a knitted fabric[4]." I used a 50% rayon and 50% mercerized cotton yarn to hand knit this garment and gauges were tested on both size six and eight needles. Size six needles were used for the rib knit pattern squares, while size eight needles for the stockinet pattern in the rectangular bodice of the dress.

[3] Vogue Knitting. www.vogueknitting.com
[4] June Hiatt, *The Principles of Knitting Methods and Techniques of Hand Knitting* (New York: Simon and Schuster, 1988), 415.

Squares have been used extensively in both knitted and crocheted objects. Medallions or "granny squares" are knitted or crocheted geometric shapes that are joined together to create a larger object[5]. The commonly known "granny square" has been used in garments and home goods for years. The designer's goal was not reinvent the "granny square," but to explore a new use of squares in fashion apparel. Thirty-five, 7" squares were knit in a 4 x 4 rib knit (a 4 knit stitch by 4 purl stitch repeat pattern) to create the skirt of the dress. A rib knit or ribbing is defined as: "the regular alternation of sets of knit and purl stitches along a row, wherein on the second and all subsequent rows the stitches are worked as they face the knitter."[6]

The components of the dress were dyed in nine solutions with fiber reactive dyes to create the colors of autumn leaves found in the mid-western United States. Following the dye processes, the squares were wet-blocked. Blocking is the process of stretching out with rust proof sewing pins a wet or damped fabric to its intended dimensions to exhibit the stitch pattern[7]. After the garment pieces were hand sewn together, I sprayed the entire dress with the same colors of dyes to add cohesiveness to the garment's color palette. To determine color placement and the drape of the dress I pinned the squares on a dress form.

A challenge I encountered was compensating for the elastic properties of the rib knit, since the wales and courses of the knit rib knit squares were not configured in a typical vertical or horizontal manner on the garment. Each square was placed "on point," in opposite directions; therefore the rib knits were oriented diagonally, counterbalancing the typical stretch qualities of a 4 x 4 rib knit. (Fig. 2.)

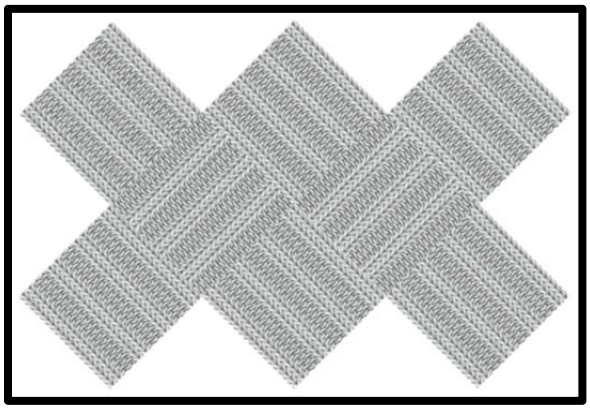

Figure 2. *CAD Simulation of the Knit Pattern Using Kaledo Knit for Metalling with Fibers XXX: A Study in Geometry. Image by author.*

One large rectangle was knit with a stockinet stitch to create the bodice. Hiatt[8] defines a fabric with knits stitches only on the front side and purl stitches on the back side as a stockinet stitch pattern. The metal backs of the decorative bar studs were strung onto the yarn, and then knit into the fabric on the knit rows

[5] Montse Stanley, *Reader's Digest Knitter's Handbook* (New York: Reader's Digest Association, 1993), 104.
[6] Maggie Righetti, *Knitting in Plain English* (New York: St. Martin's Press, 1986) 131.
[7] June Hiatt, *The Principles of Knitting Methods and Techniques of Hand Knitting* (New York: Simon and Schuster, 1988), 391.
[8] June Hiatt, *The Principles of Knitting Methods and Techniques of Hand Knitting* (New York: Simon and Schuster, 1988), 18.

of the pattern. This rectangle created the bodice of the dress, so that the wearer's shoulders support the weight of the knitted fabric.

As a designer, it is essential to evaluate both the challenges and successes of the process and the final product created. For this project I identified two challenges and possible changes to the project, if replicated, to consider in future projects in regards to social responsibility. First, I would choose to use natural dyes, instead of synthetic dyes to enhance the socially responsible design practices used in the garment by metal reuse. Second, I would substitute a 100% cotton fiber yarn for the cotton/rayon blend yarn used to knit the garment to support a somewhat more environmentally friendly textile fiber than rayon.

Process wise the project was a success, I was able to develop a garment that met the original design objectives by reusing metal in a portable knit project that accentuated colors found in nature. (Fig. 3) In addition, the project was deemed successful since the garment received the ATEXINC Award[9] for Excellence in Marketable Textile Design at the 2008 International Textile & Apparel Association[10].

Figure 3. *Metalling with Fibers XXX: A Study in Geometry front view and detail, 2008. Image by author.*

In 2009 I created Metalling with Fibers *XXXII: Desert Sunset,* (Fig. 4) a shibori hand-dyed silk dress created from four large rectangles, placed on the bias. During my studies with Robert Hillestad I developed a love for tassels. In this dress, I created various lengths of metal tassels by hand backstitching together the same metal backs of bar studs used in *Metalling with Fibers XXX: A Study in Geometry*. This garment and a companion garment received third place in the Surface Design Association[11] Fashion Show in 2009. To date, this is the only garment made from a woven fabric in the series, although I have started sampling hand embroideries with metal findings.

[9] Apparel and Textile Education Xchange, Gainesville, Georgia. www.atexinc.com/index.htm
[10] International Textile and Apparel Association. www.itaaonline.org
[11] Surface Design Association. www.surfacedesign.org

Figure 4. *Metalling with Fibers XXXII: Desert Sunset, front view, 2009. Image by author.*

As a designer, I also create scarves to be sold in retail environments. I find that my work both as a commercial designer and fiber artist inform and influence the pieces created in both environments. *Metalling with Fibers VII* (Fig. 5) is an example of a hand-knitted scarf created by stringing metal washers from the backs of tack buttons for jeans onto the yarn. After the scarf was knitted, it was then dyed with fiber reactive dyes. However, there were three problems I encountered with stringing the metal washers onto the yarn. First, the constant need to add more washers, therefore the yarn needed to be cut creating an additional tail that needed to be woven into the finished knitted fabric. Second, the washers created weight and tension on the yarn as I was knitting. Third, the washers abraded against the yarn weakening the fibers to the point of breakage at times.

Figure 5. *Metalling with Fibers VII, full view and detail, 2008. Image by author.*

Over the last couple of years I decided to incorporate crocheted pieces into this series. As previously mentioned, the primary concern with incorporating metal into textile art is the weight on the garment or article. With hand knitted fabrics I experienced an additional challenge of the metal destroying the elasticity and recovery of the fabrics; however, crocheted fabrics are a firmer construction that provides a stable foundation for metal. The other advantage of incorporating metal into crocheted fabrics is the freedom of adding the metal components while each stitch is crocheted, versus stringing the metal onto the yarn. Therefore the aforementioned problems with abrasion are eliminated. *Metalling with Fibers XII: Rocky Mountain Sky* (Fig. 6) and *Metalling with Fibers XXXXI: A Study in Form* (Fig. 7) are examples of crocheted fiber art incorporating metal buckles and washers.

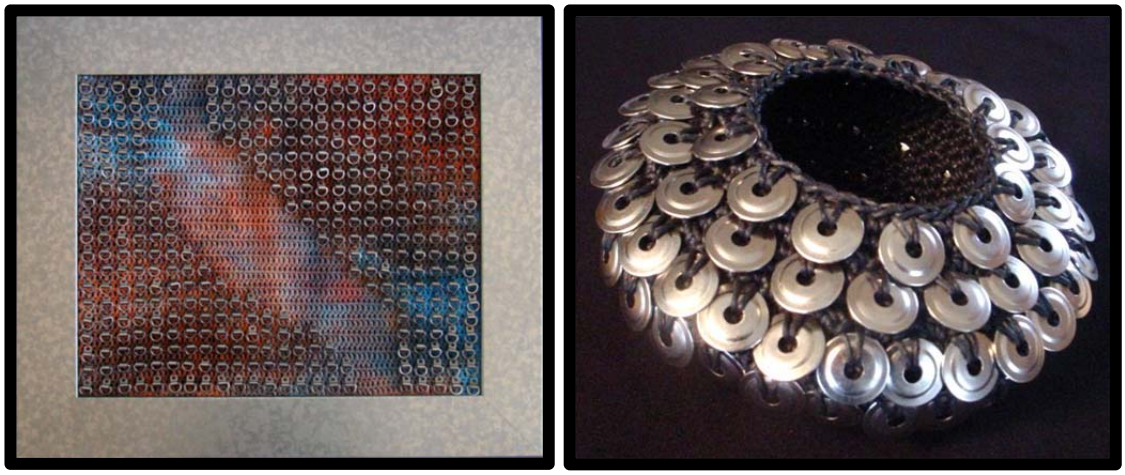

Figure 6, left. *Metalling with Fibers XII: Rocky Mountain Sky, 2009. Image by author.*
Figure 7, right. *Metalling with Fibers XXXXI: A Study in Form, 2008. Image by author.*

So how are metal findings obtained to use in your own wearable and fiber art? One venue is garment manufacturers. Although apparel manufacturing occurs globally, many companies or their design facilities still receive samples of findings from vendors which go unused. Contacting vendors of findings directly is another option, since samples of the findings often are made to show designers or bulk quantities are produced, but not purchased by manufacturers. Another viable source for findings is locale fabric stores, who also receive samples from vendors. A source that may not provide large quantities are thrift stores and clothing that is to be recycled providing sources of findings that may easily be removed from garments.

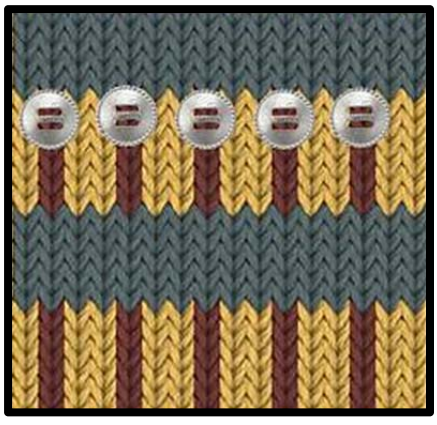

Figure 8*. Virtual Simulations of Patterns using Kaledo Knit and Adobe PhotoShop. Image by author.*

Regardless of source for findings, I have found in my design work that it is useful to graphically outline my design process as previously illustrated. Thus far I have created over twenty pieces in this design series and from the information gained from my processes, I propose the following process model for integrating metal finding reuse in traditional textile arts to share with designers and artists. (Fig. 8) As with most creative processes, the materials inform the ideation process for the design or product and vice versus. In my work the materials and the final product share a bi-directional relationship as I make decisions about materials and the final product through the creation of swatches or samples to test the compatibility of the material's physical characteristics in relation to the design/product.

The testing stage of my design process is often enhanced through the use of computer-aided design technologies. Resources such as time and energy are conserved by virtually exploring placement of metal findings in the design to understand how the metal components integrate with elements of design such as color and texture. (Fig. 9) Exploratory analysis of the materials, design/product, and outcomes from CAD testing provides a foundation for deciding which structural techniques I will use for the final design/product; taking into consideration the weight and end use of the final product.

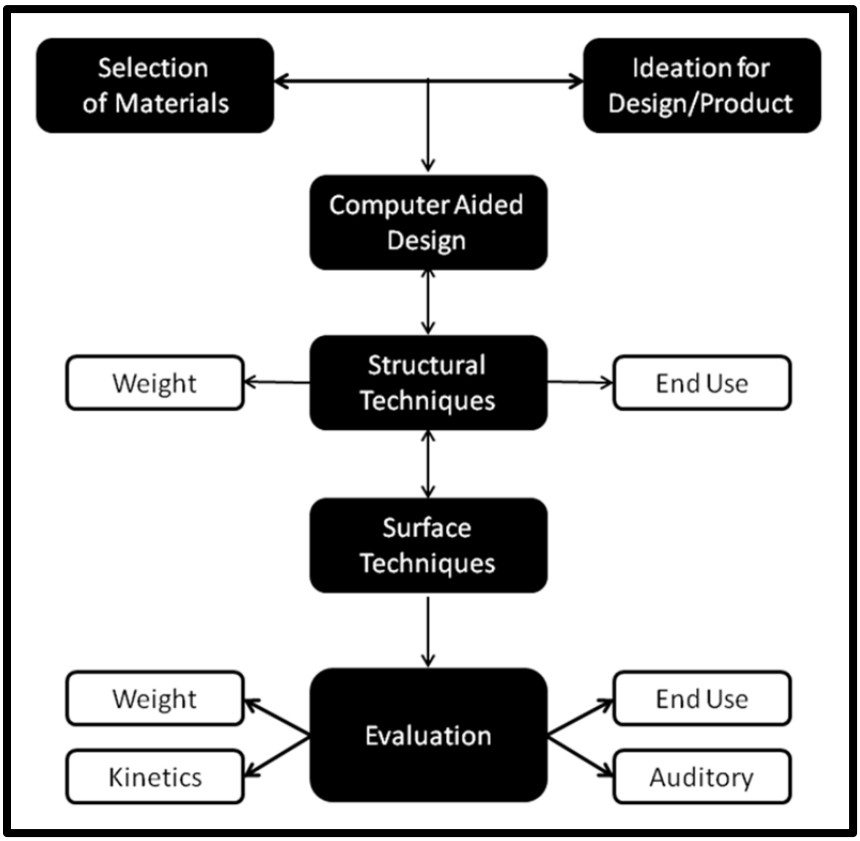

Figure 9. *Model for integrating metal findings reuse in traditional textile arts. Image by author.*

As a designer and artist, I delineate textile design into structural techniques such as weaving, knitting, crocheting, and binding. I define surface techniques to include dyeing, painting and embroidery, although dye processes, as in the case of shibori[12], can result in structural forms. Generally, in my work for this series, surface embellishments are applied after the structural techniques. The metal is integrated into the piece during the structural techniques.

[12]World Shibori Network, Berkeley, California. http://shiboriorg.wordpress.com/

The final and most salient stage in the proposed process is evaluation, since the information gained from this stage generally informs the next design project. Currently, during the evaluation stage I am focusing on the weight and end use of the design/product to determine successes, areas of improvement, and innovation strategies for designs/products.

I plan to continue to expand my *Metalling with Fibers Series*, because I believe that I still have much exploration ahead in regards to materials, design/products, and processes. I envision including hand embroidery in future projects, plus conduct studies examining the kinetic and auditory qualities of the wearable art pieces created. It intrigues me to understand the human interface of the wearer and these metal infused garments. Process wise, I plan to integrate virtual 3-dimensional modeling of the fabrications and garments, prior to creation to help predict the affect of the metal on the textiles and the wearer. Lastly, I have a goal of integrating surface techniques such as dyeing, painting and embroidery prior to the structural techniques or simultaneously. I foresee that the next ten or more years of my work will be materialized through metal.

Bibliography

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Acknowledgements

Thank you to Dr. Robert Hillestad for your friendship and guidance.