

**Trinidad Carnival:
Improving Design through Computation and Digital Technology**

by

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by
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ABSTRACT

This thesis explores the integration of computation and digital technology to support design in the Trinidad Carnival. I argue that computation can contribute to design in the Trinidad Carnival by (1) addressing the dying art of wire bending, (2) improving design, and (3) by fostering a more inclusive design process.

My study is motivated by the current design problems in the Trinidad Carnival. They include the dying art form of wire bending, the lack of time and resources to generate design alternatives, the lack of an inclusive design process, and the lack of community involvement in "making" in Carnival.

To address these problems, I develop support based on a comprehensive study of the existing situation, and explore the integration of computational tools and digital technology in the design process. To that end, I (1) develop the Bailey-Derek wire bending grammar to capture the unique, traditional art form of wire bending, (2) propose a new, more inclusive design process, (3) use computation and digital technology to enable the generation of design alternatives and create "objects to think with" in the design process, and (4) add to the understanding of a design process outside the domains of product, industrial, architecture, and engineering design.

These explorations are significant because: 1. The wire bending shape grammar can be used as an educational tool to address the current absence of a system to pass on this dying art form; 2. A digital tool can be developed from the encoding of the visual design features in wire bending further supporting this art form; and 3. The integration of computation and digital technology in the design process can improve design by creating a more inclusive design process, allow the generation of design alternatives, and creating "objects to think with" in design.

The Carnival of Trinidad has spawned more than 70 carnivals around the globe. It is the most copied, but yet most understudied carnival in the world. This thesis fills a gap in current literature by taking a computational and design perspective to this phenomenon.

Thesis Supervisor: Azra Aksamija
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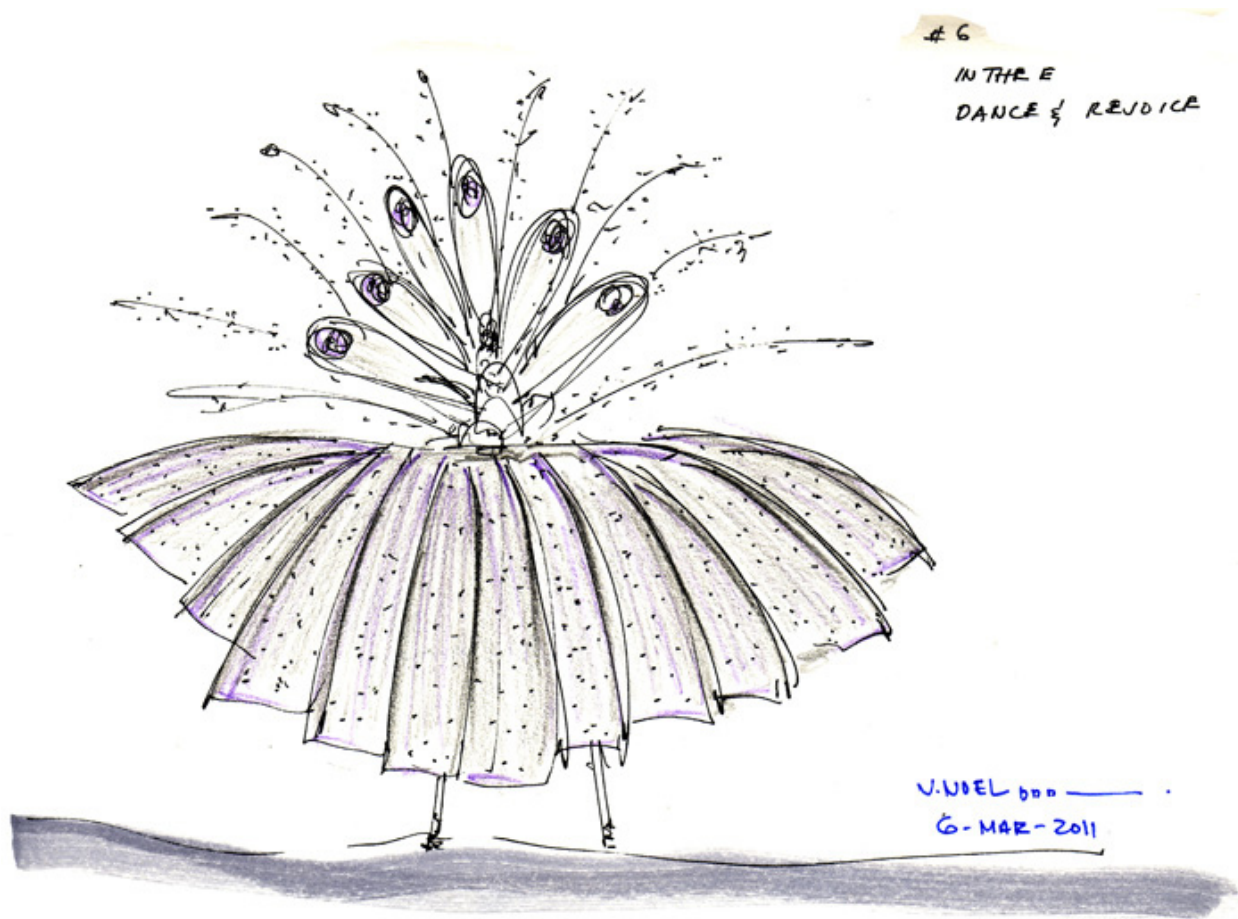
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Trinidad Carnival: Improving Design Through Computation And Digital Technology



"In the End, Dance & Rejoice"
Drawing © Vernelle A. A. Noel 2011

By Vernelle A. A. Noel

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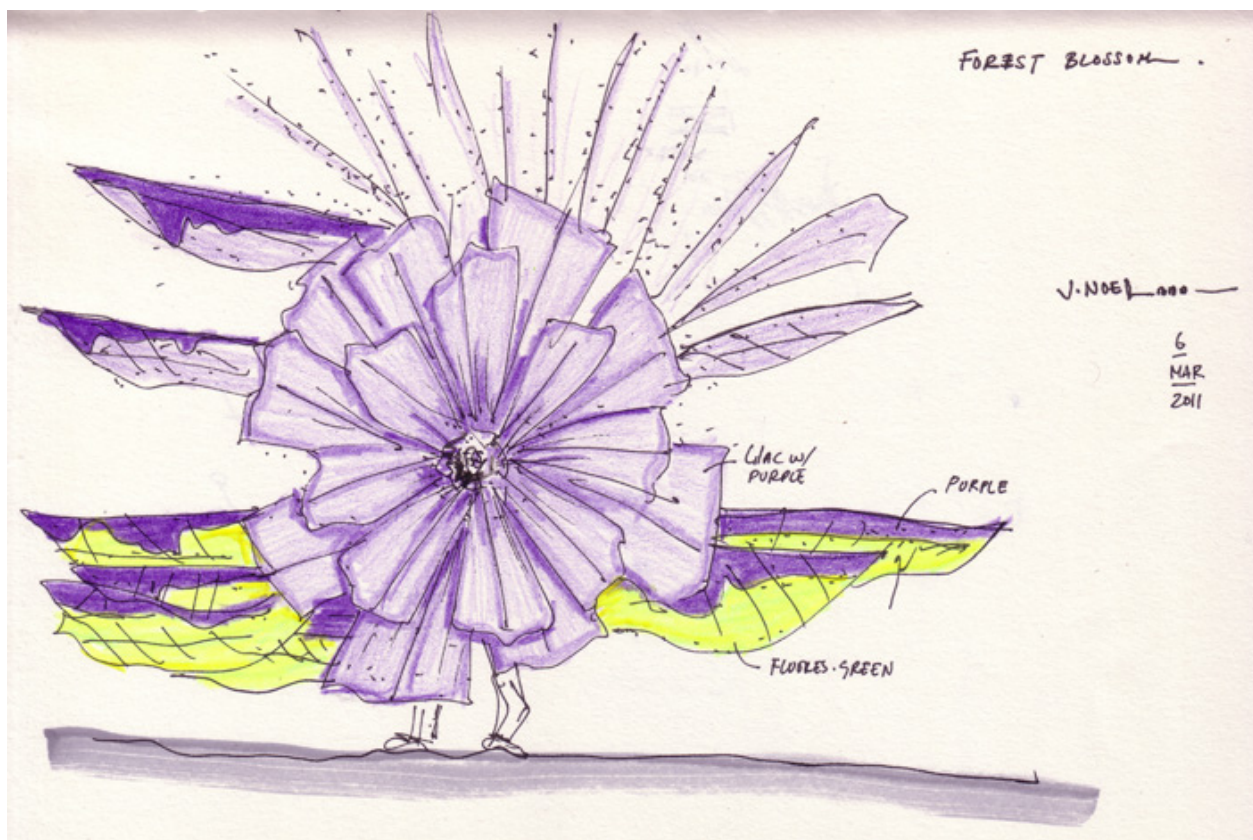
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Chapter 1: Introduction

- 1.1 Statement of the Problem
- 1.2 Methodological Framework
- 1.3 Hypothesis
- 1.4 Thesis Structure



"First Blossom"
Drawing © Vernelle A. A. Noel 2011

1 Introduction

In this thesis, I am conducting design research in the Trinidad Carnival, also called masquerade or mas' for short. My specific aim is to increase our understanding of the design process in carnival, with the intention to provide design support.¹ In particular, I seek to, investigate reasons for the current “bikini and beads” aesthetic in mas, address the dying art of wire bending – used in costume construction, improve design, and bring the culture of “making” back into the carnival.² My research question is therefore, how can computation, and digital technology (1) support design processes and cultural values in the Trinidad Carnival, (2) advance design knowledge, and (3) further the development of design support?³

1.1 Statement of the Problem

This study is motivated by the current problems in design in the Trinidad Carnival. They include (1) the dying art form of wire bending, (2) the lack of time and resources to generate design alternatives, (3) the lack of an inclusive design process, and (4) the lack of involvement by communities in “making” in Carnival.

¹ The term support refers to possible aids and measures that can be used to improve design. This includes methodologies, procedures, software, checklists, techniques, tools, organizational structures, standards and regulations, etc. that address one or more aspects of design (Lucienne T. M. Blessing, Amaresh Chakrabarti, and Lucienne T. M. Blessing, *DRM, a Design Research Methodology [electronic Resource]* / Lucienne T. M. Blessing, Amaresh Chakrabarti (Dordrecht ; New York : Springer, c2009., 2009).

² Bikini and beads describes the aesthetic of the costumes which may comprise a bikini top and bottom, with colorful beads, jewels, and feathers for decoration.

³ With computation, I refer to rule-based design for analysis and synthesis. With digital technology, I refer to scripting, design software, CAD/CAM technologies, motion sensing devices, etc.

In this thesis, I address a present gap in knowledge, and address current problems in design in the Trinidad Carnival by conducting design research. This was accomplished by:

- (1) Analyzing current design processes in the Trinidad Carnival,
- (2) Developing design support in the form of a shape grammar that captures the traditional art form of wire bending, and
- (3) Testing the integration of computation and digital technology for:
 - (i) Generating design alternatives
 - (ii) Creating objects “to think with” in design, and
 - (iii) Developing a more inclusive design process.

Thus far, all of the above are lacking in research on the Trinidad Carnival.

1.2 Methodological Framework

1.2.1 Research Methodology and Design

According to the Design Research Methodology (DRM) by Blessing and Chakrabarti (2009), my research project can be classified as research Type 5.⁴ This type of project develops support based on a comprehensive study of the existing situation. To that end, data was collected by:

1. Field research in Trinidad between December 2012, and January 2013.
2. Conducting 18 in-depth interviews with those involved in the design process.
3. Conducting 9 interviews with masqueraders – persons who take part in the parade in carnival - via email.
4. Interviewing a documentary filmmaker on Trinidad Carnival.
5. Carrying out observations at nine (9) Mas Camps⁵.
6. Studying videos, and documentaries on the Trinidad Carnival.
7. Studying literature on Carnival.
8. Reviewing video footage and photo documentation from field research, and
9. Participating in the design process at one (1) Mas Camp.

Documentation took the form of field notes and sketches which recorded who, what, when, where, and design details of my research. All interviews were audio recorded

⁴ Blessing, Chakrabarti, and Blessing, *DRM, a Design Research Methodology [electronic Resource]* / Lucienne T. M. Blessing, Amaresh Chakrabarti.

⁵ Mas Camp – the place where costumes and other artifacts for specific carnival bands are showcased, assembled, distributed, and rehearsed.

with participants' permission.⁶ Visual documentation in the form of photography and video footage was used to capture much of my data. I was a participant observer at one Mas Camp, where I witnessed and analyzed the activities for several days, and participated in some planning and creative tasks. After on-site and off-site data collection, I transcribed and analyzed my interviews, reviewed my notes, and catalogued photos. All of the above formed a comprehensive empirical study of the existing design process and culture in the Trinidad Carnival.

Based on my study and analysis, I developed a Reference Model (Fig. 78), representing my understanding of the existing situation. Based on this Reference Model, I created an Impact Model (Fig. 79) pinpointing the support I propose, and the desired effects.

These models were important for improving my understanding by linking findings in my research, establishing the scope of my research, illustrating my line of argumentation, identifying the factors I address and my intended support, and encouraging discussion, and reflection on the situation.

1.2.2 Theoretical Framework

In this thesis, I employ Engestrom's [1987] model of Activity Systems to best explain and analyze interactions in the activity of design in the Trinidad Carnival (Fig. 1). My research into the phenomenon of Trinidad Carnival is best understood by considering

⁶ COUHES Permission to Participate in research

the people, tools, goals, and the community within which this social and cultural design activity takes place.⁷ This theoretical framework also allows further analysis into the relations between components in the activity system.

Activity System
[Engeström 1987]

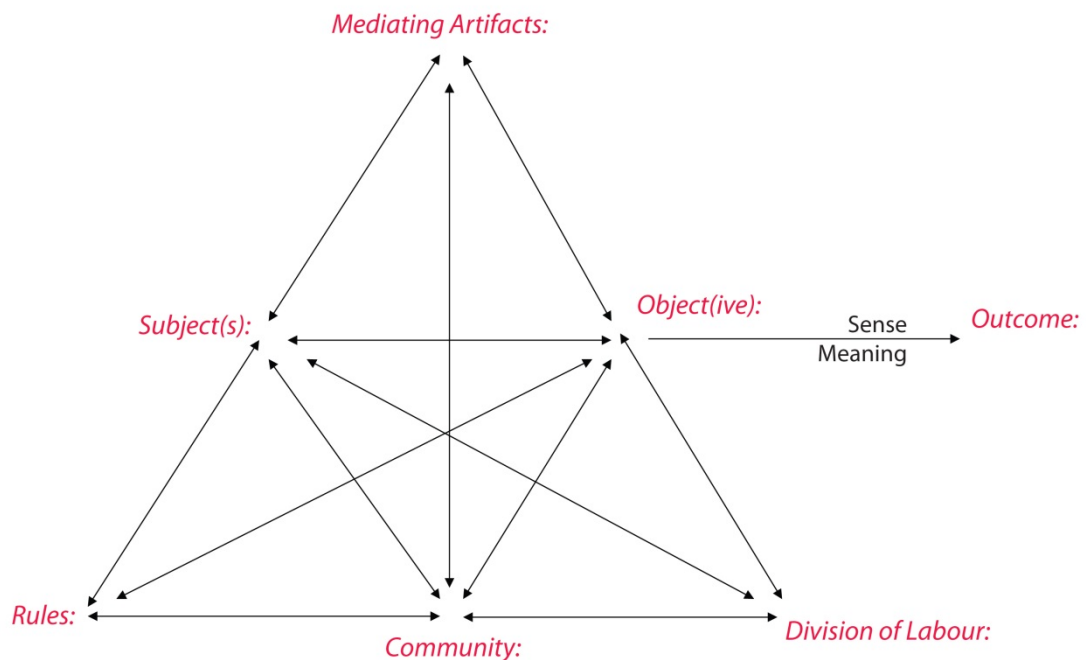


Figure 1 - Activity System according to Engestrom [Engestrom 1987]

Subjects in an activity system are the individuals or groups engaged in the activity (Fig. 1). In the context of design in carnival, subjects include bandleaders, designers, artists, and prototypists, to name a few. Mediating artifacts are the tools, models, and methods

⁷ David H. Jonassen and Lucia Rohrer-Murphy, "Activity Theory as a Framework for Designing Constructivist Learning Environments," *Educational Technology Research and Development* 47, no. 1 (March 1, 1999): 61–79.

used in the process. Examples of mediating artifacts include drawings, models, computers, and design methods. The ways in which mediating artifacts and tools are used, shapes the objects and the way the objects are acted upon. Object(ive)s in the activity system are the results and representation of the activities. In the context of design in carnival and my research, the object(ive) includes costumes, parades, and other artifacts. The community in an activity system refers to individuals or groups who share in the object(ive) and social meaning of the activity. In the Trinidad carnival this includes the government, the society, organizations such as NCC (National Carnival Commission), and NCBA (National Carnival Bandleaders Association), and customers. Rules are the guidelines, conventions, and social interactions acceptable by the community to accomplish the object(ive). Division of labor refers to the specialty of individuals or groups, and tasks within the community.⁸

1.3 Hypothesis

I hypothesize that the development of a design process in the Trinidad Carnival that integrates computation and digital technology can:

1. Capture the traditional art form of wire bending
2. Allow the generation of design alternatives, and
3. Foster a more inclusive and diverse design process.

⁸ N.-I. Boer, P.J. van Baalen, and K. Kumar, "An Activity Theory Approach for Studying the Situatedness of Knowledge Sharing," in *Proceedings of the 35th Annual Hawaii International Conference on System Sciences, 2002. HICSS*, Jan., 1483–1492.

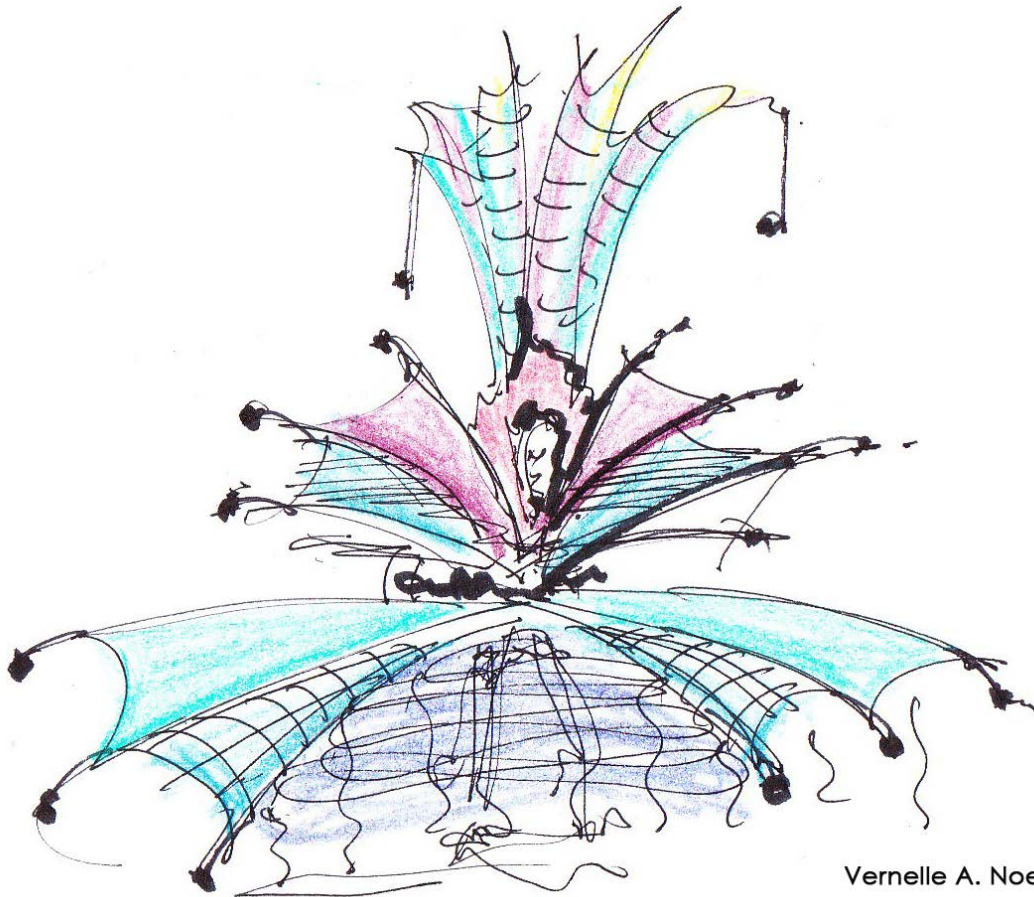
1.4 Thesis Structure

This thesis is divided into six (6) chapters. Chapter 1, Introduction, presents what I am exploring in this thesis and why. I bring forth the problems that I am addressing, how I am addressing it, and why I choose to address them in this manner. Chapter 2, Background, gives a brief overview of research pertinent to the Trinidad Carnival – theory, impact, and possible reasons for the current “bikini and beads” aesthetic. I also present research on the application of computation and digital technology to support cultural values and define cultural identities. Finally, I present literature on the power of things and thinking. I also identify gaps in current research, and areas for future research. Chapter 3, Analysis, presents my investigation of design in the Trinidad Carnival. I use Engestrom’s activity system model and Blessing and Chakrabarti’s DRM research methodology for my theoretical and conceptual frameworks respectively. Chapter 4, Results, introduces the Bailey-Derek wire bending grammar that formalizes aspects of the unique art form of wire bending. Chapter 5, Experiment, demonstrates the application of shape grammars for synthesis, and uses digital fabrication processes to create “objects to think with” in design. Chapter 6, Conclusion, presents recommendations, my proposal to use computation and digital technology in the design process, next steps and possible implications for cultural design practices.

Chapter 2:

Background

- 2.1 Carnival Theory
- 2.2 History of Trinidad Carnival
- 2.3 Literature Review
 - Carnival
 - Computation
 - Things & Thinking
- 2.4 Summary



Vernelle A. Noel

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2 Background

2.1 Carnival

Carnival as a formal institution – custom important to a society - is performed in Trinidad & Tobago, Brazil, and the USA in New Orleans Mardi Gras.⁹ In 1783, under the Cedula de Poblacion, foreigners and Spaniards of the Catholic faith and free colored people were allowed to settle in Spanish colonies and receive land. This included the island of Trinidad. During this time, several French and African planters migrated to Trinidad from neighboring Caribbean islands bringing with them the institution of carnival.¹⁰ In this period before the emancipation of slaves in 1834, carnival was marked by elaborate balls, masking, disguising, house to house visiting, and street parading on foot or in carriages, music, dancing, and frolicking.¹¹

⁹ Milla Cozart Riggio, *Carnival: Culture in Action—the Trinidad Experience* (New York: Routledge, 2004).

¹⁰ Andrew Pearse, "Carnival in Nineteenth Century Trinidad," *Caribbean Quarterly* 4, no. 3/4 (March 1, 1956): 175–193; Errol Hill, *The Trinidad Carnival* (London: New Beacon Books, 1997); Milla C. Riggio, "Introduction: Resistance and Identity: Carnival in Trinidad and Tobago," *TDR (1988-)* 42, no. 3 (October 1, 1998): 7–23; Milla Cozart Riggio, ed., *Carnival: Culture in Action - The Trinidad Experience*, 1st ed. (Routledge, 2004).

¹¹ Pearse, "Carnival in Nineteenth Century Trinidad."

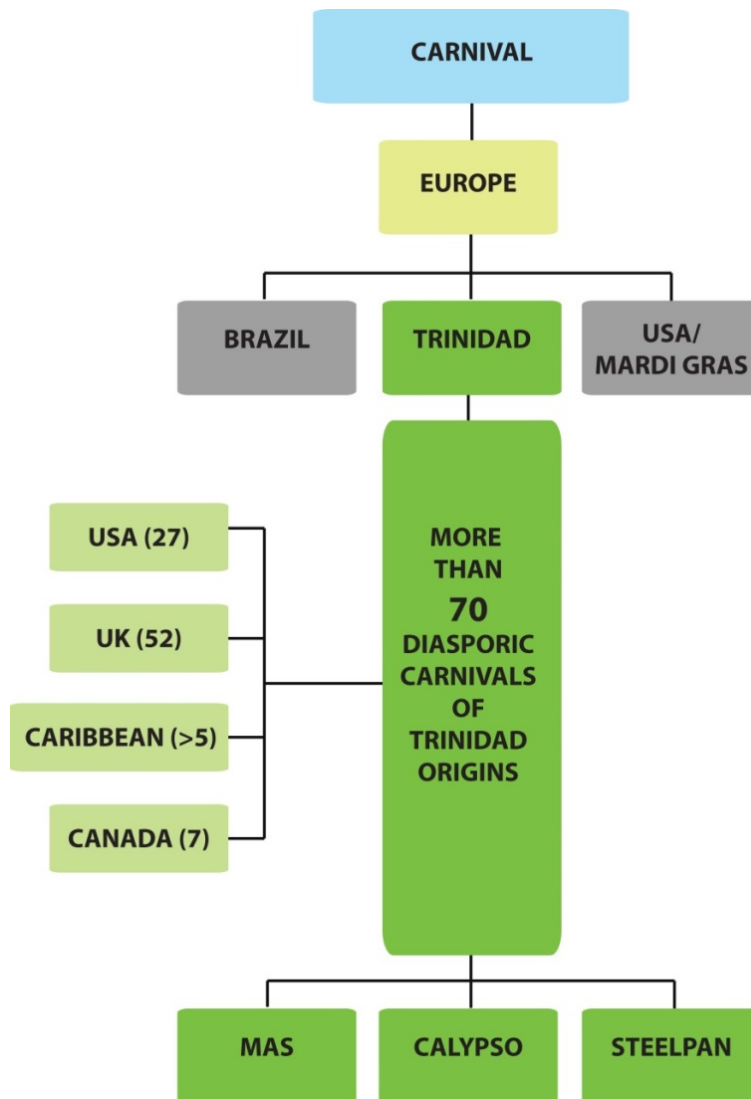


Figure 2 – The genesis and extent of the Trinidad Carnival
The Trinidad Carnival spawned more than 70 diasporic carnivals globally

In 1834, emancipated slaves celebrated and commemorated their freedom by reenacting *cannes brules* in a carnival style.¹² For these former slaves, not only was carnival a celebration, but a way for them to express their creativity, “[a]esthetic and

¹²*Cannes brules* or *Canboulay* is a reenacting of the days when enslaved Africans were driven with cracking whips, horns, shells, and cries urging them to put out fires on sugarcane plantations.

ethical sensibilities".¹³ The European elite, however, felt that "the carnival degenerated into a noisy and disorderly amusement for the lower classes".¹⁴ By 1919, carnival became a symbol of freedom with drive for sponsorship and prize-giving in well-organized competitions.¹⁵ The three main elements which define the Trinidad carnival are mas', calypso, and steelpan.¹⁶ The Europeans introduced carnival to Trinidad; the slaves brought the music, the dancing, and the energy to Trinidad Carnival as we know it today.¹⁷

2.2 Costuming in the Trinidad Carnival

The first scholarly articles on Trinidad Carnival were published in 1956. They include, "Carnival in Nineteenth Century Trinidad" by Andrew Pearse,¹⁸ "The Traditional Masques of Carnival" by Daniel J. Crowley,¹⁹ and "The Changing Attitude of the Coloured Middle Class towards Carnival" by Barbara E. Powrie.²⁰ In the 1950's, the themes of carnival bands were about history and fantasy. Band presentations (Fig. 3)

¹³ Ernest D. Brown, "Carnival, Calypso, and Steelband in Trinidad," *The Black Perspective in Music* 18, no. 1/2 (January 1, 1990): p.85.

¹⁴ Pearse, "Carnival in Nineteenth Century Trinidad", p.183.

¹⁵ Errol Hill, *The Trinidad Carnival: Mandate for a National Theatre* (London: University of Texas Press, 1972).

¹⁶ Calypso – the music and rhythm native to Trinidad (Carol Martin, "Trinidad Carnival Glossary," *TDR (1988-)* 42, no. 3 (October 1, 1998): 220–235); Steelpan – musical instrument invented in Trinidad & Tobago by the African working class from oil drums.

¹⁷ Keith Nurse, "Globalization And Trinidad Carnival: Diaspora, Hybridity And Identity In Global Culture," *Cultural Studies* 13, no. 4 (1999): 661–690.

¹⁸ Pearse, "Carnival in Nineteenth Century Trinidad."

¹⁹ Daniel J. Crowley, "The Traditional Masques of Carnival," *Caribbean Quarterly* 4, no. 3/4 (March 1, 1956): 194–223.

²⁰ Barbara E. Powrie, "The Changing Attitude of the Coloured Middle Class Towards Carnival," *Caribbean Quarterly* 4, no. 3/4 (March 1, 1956): 224–232.

were renowned for their “meticulously detailed construction and brilliant costuming”.²¹ Designers like George Bailey (1935 – 1970), Harold Saldenha (1925 – 1985), and Carlisle Chang (1921 – 2001) were synonymous with this period, which came to be known as the “Golden Age of Masquerade”.²² The techniques and aesthetic of this period served as a standard of excellence.



Figure 3 - Costuming in Trinidad Carnival, 1950's
Photo © <http://www.wikipedia.org>

Some traditional characters in the Trinidad Carnival include the Midnight Robber, Dragons, Pierrot Grenade, Sailors, and the Bat. For the Bat (Fig. 6 and Fig. 7) the masqueraders' arms are connected to, and manipulate bat wings with feet attached to the bottom of the wings. Costume construction was described as follows: “Wings are

²¹ Band – a group of masqueraders; Garth L. Green and Philip W. Scher, *Trinidad Carnival: The Cultural Politics of a Transnational Festival* (Indiana: Indiana University Press, 2007). p.5.

²² Ibid.

fabricated from wire and bamboo to a wingspread of 12 to 15 feet, and are covered with the same cloth as the skin fit. They are fastened to the costume by hooks-and-eyes, zippers, or sometimes by sewing. In any case the masque[rader] is sewn into his clothes with his arms permanently fastened to the wings".²³ According to Green & Scher, the 1970's saw the disappearance of traditional characters; and the appearance of local historical events and nature as themes for band presentations.²⁴ The 1970's also saw the arrival of designers, Wayne Berkeley (1940-2011), and Peter Minshall (1941 – present) into the Trinidad Carnival.

²³ Crowley, "The Traditional Masques of Carnival." p.219.

²⁴ Garth L. Green and Philip W. Scher, *Trinidad Carnival: The Cultural Politics of a Transnational Festival* (Indiana: Indiana University Press, 2007), p.12.



Figure 4 – Detailed costuming, 2010

Aesthetic A - meticulously detailed construction and brilliant costuming
Photo © <http://www.macfarlanecarnival.net>



Figure 5 – Bikini & Beads Aesthetic

Aesthetic B - bikini, beads, & feathers
Photo © Trinidad & Tobago Carnival Costume Photos

Minshall researched into the structural principles of the Bat and brought it back into the carnival in the 1970's. He conducted experiments, and developed new forms for expressing human energy through the Bat's structural principles. Minshall and Berkeley were at the forefront of design transformations in Trinidad Carnival from the 1970's – 2000's.



Figure 6 – The Bat

Sketch of traditional character the Bat²⁵



Figure 7 – The Bat

Photo © Jeffrey Chock²⁶

In 1988, “skimpy mas” or pretty mas’ appeared in the Trinidad Carnival. It called for less elaborate construction and was the genesis of “bikini and beads” in mas’ (Fig. 5).²⁷

²⁵ Crowley, “The Traditional Masques of Carnival.”

²⁶ Ruth Stegassy, “John Cupid: We Have Been Called Carnival People: An Interview,” *TDR* (1988-) 42, no. 3 (October 1, 1998): 96–107.

²⁷ Green and Scher, *Trinidad Carnival: The Cultural Politics of a Transnational Festival*.

2.3 Literature Review

This section presents research pertinent to (1) the Trinidad carnival, (2) the employment of computation and digital technology to support cultural values, and (3) the power of using objects as things “to think with”.

2.3.1 The Trinidad Carnival

The Carnival of Trinidad is the “most copied yet least studied major carnival in the world”.²⁸ Where this phenomenon has been studied, however, has been from a historical, socio-political, anthropological, ethnographic, economic, and cultural perspective (Fig. 8). Knowledge of these perspectives is important in understanding this phenomenon so that the current problems occurring in design can be properly addressed.

Carnival theory is usually based on the work of Mikhail Bakhtin and characterized by a temporary suspension of hierarchy of society and individuals, with all participants being considered equal. Carnival for Bakhtin was a cultural form where the social norms, laws, and inhibitions of everyday life were suspended.²⁹ His theory of carnival is based on a non-democratic society, which is different from the Trinidadian society.

²⁸ Riggio, introduction to *Carnival*, 2004.

²⁹ M. M. Bakhtin, *Rabelais and His World*, by Mikhail Bakhtin. Translated by Helene Iswolsky (Cambridge, Mass. M.I.T. Press [1968], 1968).

Unlike Bakhtin's carnival, the Trinidad Carnival was developed as a form of celebration and as a means of expressing a people's creativity. Whereas in Bakhtin's model, carnival is an opportunity for people to be free of authority, the Trinidad Carnival is supported by government institutions, and the people. Carnival in Trinidad consumes the entire population, occupies much of the consciousness of the country, and is filled with much competition.

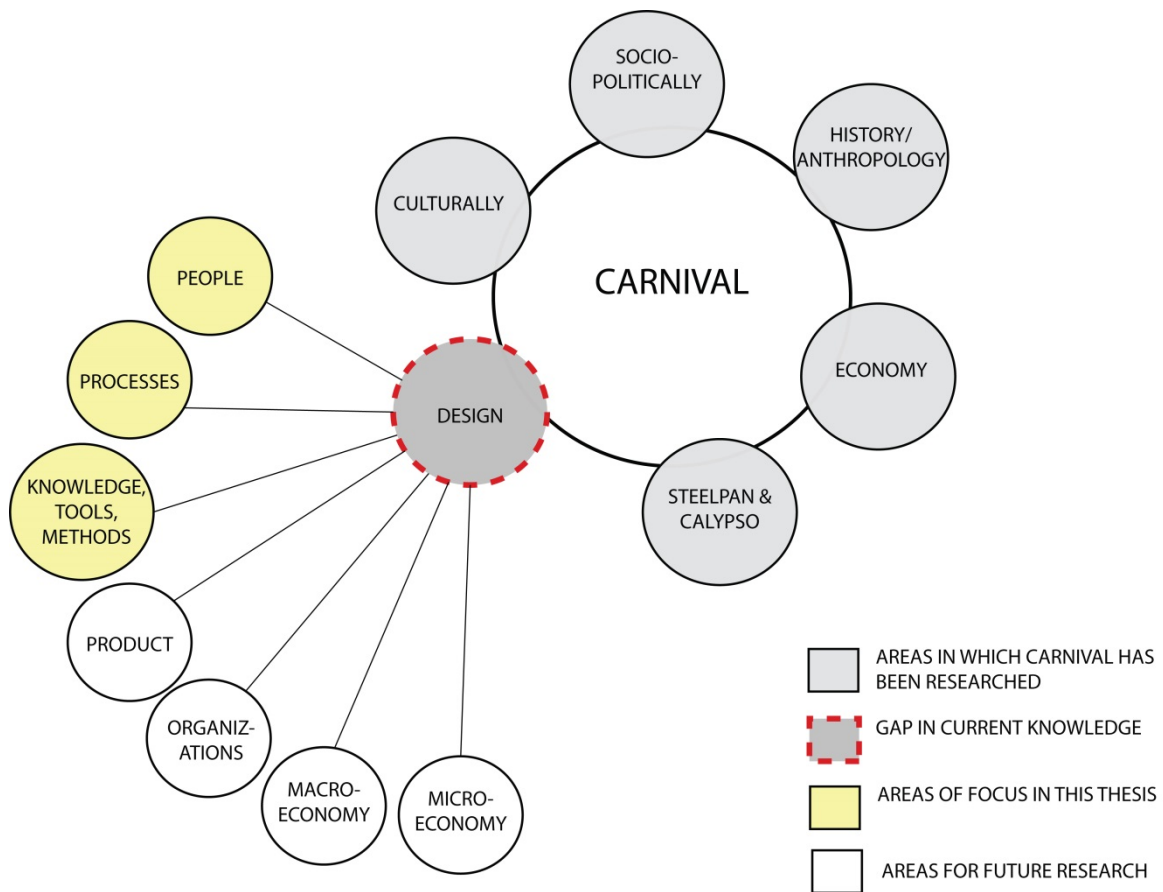


Figure 8 - Research in the Trinidad Carnival

Literature on Trinidad Carnival mostly takes a historical, socio-political, anthropological, ethnographic, economic, and cultural perspective.³⁰ There is a lack of literature on design in the Trinidad Carnival with no studies looking at it through the lens of design (Fig. 8).³¹ My thesis will fill this existing lack. The difference between Bakhtin's model of carnival and the Trinidad Carnival, the impact of the Trinidad Carnival on the global cultural economy, and the transformations in costuming in the Trinidad Carnival, from the traditional characters to the current "bikini and beads" aesthetic is discussed.

Milla Riggio (2004) in her compilation of a body of works in *Carnival: Culture in Action – The Trinidad Experience* presents a theoretical redefinition of carnival based on the values and sense of community that the Trinidad Carnival encourages.³² In this compilation, Richard Schechner in his essay entitled *Carnival (theory) after Bakhtin*, discusses the Trinidad Carnival, based on the celebration of freedom. Schechner tells us that the Bakhtinian model of playing (carnival) is a bottom-up one, where there is "rebellion, mockery of authority [and] freedom from constraints".³³ The Trinidadian model however, is both top-down and bottom-up. In the Trinidad Carnival the activities

³⁰ Ruth Wuest, "The Robber in the Trinidad Carnival," *Caribbean Quarterly* 36, no. 3/4 (December 1, 1990): 42–53; Brian Honoré, "The Midnight Robber: Master of Metaphor, Baron of Bombast," *TDR (1988-)* 42, no. 3 (October 1, 1998): 124–131; Max Harris, "The Impotence of Dragons: Playing Devil in the Trinidad Carnival," *TDR (1988-)* 42, no. 3 (October 1, 1998): 108–123; Errol Hill, "Traditional Figures In Carnival: Their Preservation, Development and Interpretation," *Caribbean Quarterly* 31, no. 2 (June 1985): 14–34; Hollis Urban Liverpool, "Origins of Rituals and Customs in the Trinidad Carnival: African or European?," *TDR (1988-)* 42, no. 3 (October 1, 1998): 24–37; Hollis Urban Liverpool, "Origins of Rituals and Customs in the Trinidad Carnival: African or European?," *TDR (1988-)* 42, no. 3 (October 1, 1998): 24–37.

³¹ The term "design" here refers specifically to my scope of People, Processes, Knowledge, Tools, Methods, and Context.

³² Riggio, *Carnival*, 2004.

³³ *Ibid.*, p.10.

are bottom-up, but also occurs within the structured environments of competitions, participation, and rules by the government and its officials. Schechner mentions the need for the Trinidad Carnival to remember its past and bring itself into the 21st century through current desires and technologies.³⁴ My thesis embraces this theoretical definition of the Trinidad carnival based on the sense of community, while addressing the missing focus on design. I will attempt to speak to the need to remember the past, by using computation and digital technologies to rekindle and develop the culture of making in carnival.

Keith Nurse (1999) in his paper on *Globalization and Trinidad Carnival: Diaspora, Hybridity and Identity in Global Culture*, analyzes the impact of Trinidad and its diasporic carnivals on the global cultural economy.³⁵ His analysis presents the term “globalization in reverse,” which describes Third World countries as not merely “importers of metropolitan popular culture,” but also as exporters of cultural products and performances.³⁶ Studies on the economic impact of Trinidad-style carnivals have shown the following: Notting Hill carnival in the UK attracts more than 2 million people and generates more than £93 million pounds. Labor Day celebrations in New York (USA) attracts more than 3.5 million people and generates more than USD \$154 million. Caribana in Toronto, Canada, attracts more than 1.1 million people and generates more

³⁴ Ibid., p.9.

³⁵ Diasporic carnivals – carnivals modeled after the Trinidad carnival.

³⁶ Nurse, “Globalization And Trinidad Carnival: Diaspora, Hybridity And Identity In Global Culture.” p.663.

than CND \$200 million.³⁷ Nurse also highlights mas' man, Peter Minshall, and his contributions to festivals outside diasporic communities.³⁸ Minshall has designed costumes and choreography for the Barcelona and Atlantic Olympics opening and closing ceremonies in 1992, and 1996 respectively, and the World Cup Finals (soccer) in Chicago in 1994, to name a few. Peter Minshall designed mas for other carnivals outside of Trinidad between 1973 and 1991 in London, Brooklyn, Miami, Toronto and Jamaica. Between 1987 and 1996, he designed costumes and choreographed ceremonies for stadium events, concert-spectacles, and festival performances in the USA and France. From 1969 to 1995 he designed sets and costumes for theater productions in London, USA, Germany, and Edinburgh.³⁹ In addition to Minshall's contributions over the years to culture and design in Trinidad, USA, UK, Europe, and the Caribbean, there have been many more contributions by other designers. Designers include Stephen Derek, Albert Bailey, Roland St. George, Robert Miller, and Clary Salandy.

Nurse champions the "kinetic movement", dynamism and vibrancy in costuming in Trinidad inspired carnivals.⁴⁰ The Kings and Queens of Carnival - large kinetic sculptures (dancing sculptures) can be up to 20 feet tall and/ or wide. This is a main characteristic

³⁷ Dr. Jo-anne Tull, "Money Matters – Trinidad and Tobago Carnival 2005" (presented at the Reflections on Carnival 2005, Trinidad and Tobago, 2005), http://www.academia.edu/326827/_Money_Matters_in_the_Trinidad_Carnival_.

³⁸ Mas Man – term to refer to one who designs carnivals and masquerades in carnival (costumes, performances, etc).

³⁹ Richard Schechner, Milla C. Riggio, and Peter Minshall, "Peter Minshall: A Voice to Add to the Song of the Universe: An Interview," *TDR (1988-)* 42, no. 3 (October 1, 1998): 170–193.

⁴⁰ Nurse, "Globalization And Trinidad Carnival: Diaspora, Hybridity And Identity In Global Culture." p.678.

of Trinidad carnival costuming, and remains important in diasporic carnivals. Another extension to Nurse's study on the global cultural economy created by Trinidad carnival would be the carnival's global contribution to design, design culture, and design practices. The Trinidad carnival would have contributed to overseas design practices, both inside and outside the activity of carnival. The traditional practice of wire-bending in Trinidad Carnival, for example, is used in other carnivals where designers travel and teach others in these particular geographic locations. The Trinidad Carnival's "reinterpretation and redistribution" has contributed to several other local economies.⁴¹

Green & Scher in their book *Trinidad Carnival: The Cultural Politics of a Transnational Festival* (2007), discuss transformations within Trinidad and Caribbean communities through carnival, from the 1950's to the 2000's.⁴² They note the view of some, that carnival no longer demonstrates the "genius of the people;" neither does it represent the creativity of Trinidadian culture.⁴³ This view is supported by bandleader, designer, and wire bender, Stephen Derek.⁴⁴ Derek believes that the purpose of carnival is to "showcase the talent of the people," but anguishes that this is not currently happening in the Trinidad carnival. Green & Scher marks the presence of the "skimpy mas" aesthetic in the late 1980's, as a sign of the loss of the "true carnival spirit."⁴⁵ This

⁴¹ Riggio, *Carnival*, 2004. p.8.

⁴² Green and Scher, *Trinidad Carnival: The Cultural Politics of a Transnational Festival*.

⁴³ *Ibid.*, p.19.

⁴⁴ Bandleader – One who finances carnival productions; Stephen Derek, Interview by Vernelle Noel, Personal interview, Trinidad, WI. January 5, 2013; Wire bender – One who bends wire and other materials to create structures for costumes in carnival.

⁴⁵ Green and Scher, *Trinidad Carnival: The Cultural Politics of a Transnational Festival*. p.22.

abundance of “bikini and beads” has continued to be a growing concern in Trinidad carnival today (2013). Some reasons given by Green & Scher for this aesthetic are (1) the carnival’s transformation into a street party, (2) the decline of communities in producing mas, and (3) the lack of involvement by masqueraders in the making of costumes. In addition to the aforementioned reasons for the “skimpy mas” aesthetic, I noticed in my research that there seems to be no agreed understanding of what Trinidad Carnival today is, or what it should be. Based on how the Trinidad Carnival emerged - as a means of expressing creativity - I agree with Derek and believe that its main objective should be the expression and development of the creativity of individuals and communities.

Max Harris in his paper, *The Impotence of Dragons: Playing Devil in the Trinidad Carnival*, tells us that the government and commercial entities, in an attempt to “appropriate” and “prettify” carnival, financially supported aspects they sought to encourage, and ignored those they wished to discourage.⁴⁶ This directed support - when coupled with the growing middle class - led to the rise of “pretty” bands depicting happy themes, instead of the pains of slavery. Harris tells of his intrigue by the “powerful folk theatre” and “performance skills” of traditional characters (Devils, Dragons, and Imps) in the Trinidad Carnival.⁴⁷

⁴⁶ Harris, “The Impotence of Dragons.” p.111.

⁴⁷ Ibid., p.122.

Errol Hill in *Traditional Figures in Carnival: Their Preservation, Development and Interpretation*, talks about the conservancy and development of characters in the Trinidad Carnival. Hill calls for the preservation of characters with social relevance, originality, uniqueness, and history.⁴⁸ Suggestions for ways of preserving them include publishing literature, visual documentation through photography, artifacts such as dolls, and a carnival museum.⁴⁹ When it comes to development, Hill writes about characters' transformations in physical appearance, and performance as the Trinidad Carnival evolved. He mentions the adoption of new building techniques, citing Peter Minshall's development of the Bat, as an example. My work seeks to develop this cultural design activity by integrating computational approaches and tools in the design process. My work is not stifled by traditional carnival characters, but looks at new methods and techniques that build on the local practices, uniqueness, social importance and history, for design and fabrication in the Trinidad carnival.

In Green and Scher's (2007) "*Trinidad Carnival: The Cultural Politics of a Transnational Festival*", Pamela R. Franco in her essay entitled, "*The Invention of Traditional Mas and the Politics of Gender*," examines the construction and portrayal of Trinidad carnival by Daniel Crowley and Andrew Pearse. She concludes that their portrayal of the Trinidad Carnival sought to privilege males of African descent. I will focus specifically on her examination of Crowley's masculine invention of the traditions of Trinidad carnival.

⁴⁸ Errol Hill, "Traditional Figures In Carnival: Their Preservation, Development And Interpretation," *Caribbean Quarterly* 31, no. 2 (June 1, 1985): 14–34.

⁴⁹ Ibid.

Most of the traditional characters in Crowley's tracing of Trinidad Carnival are male. There are no characters that stand out as uniquely female, as even those that are female in character, can also be played by males. Of the 25 characters and bands mentioned by Crowley, only 5 allowed participation and performance by women. Franco sees Crowley's mapping of the major traditions of carnival, and his categorizing of characters, as a male-centered one.⁵⁰ Franco states that Crowley shapes our view of traditional and authentic Trinidad carnival as male, with "fully covered bodies, aggression, verbal artistry, stylized movements, [and] reenactments".⁵¹ Crowley's essays on the Midnight Robber (Fig. 9), the Dragon, and the Pierrot Grenade reinforces his focus on these uniquely male characters of stylized movements, and fully covered costuming. Other traditionally male characters include Sailors (Fig. 10), Fancy Indians (Fig. 11), and Moko Jumbies (Fig. 12). Certain traditional characters that could be played by both men and women include the Dame Lorraine (Fig. 13), Fancy Bands, and Jamettes. These characters written on by Crowley, highlight the fact that no traditional character in Trinidad Carnival stands out as being uniquely female, catering to the presence of females in carnival.

⁵⁰ Crowley, "The Traditional Masques of Carnival."

⁵¹ Green and Scher, *Trinidad Carnival: The Cultural Politics of a Transnational Festival*. p.43.



Figure 9 – Midnight Robber

Brian Honore as the Midnight Robber, at the Queen's Park Savannah in 1989. (Photo courtesy of Brian Honore)⁵²



FANCY SAILOR

Figure 10 – Fancy Sailor

Sketch of traditional character the Fancy Sailor⁵³



FANCY INDIAN CHIEF

Figure 11 – Fancy Indian
Sketch of traditional character the



MOKO JUMBIE

Figure 12 – Moko Jumbie
Sketch of traditional character the Moko Jumbie⁵⁵

⁵² Brian Honoré, "The Midnight Robber: Master of Metaphor, Baron of Bombast," *TDR* (1988-) 42, no. 3 (October 1, 1998): 124–131.

⁵³ Crowley, "The Traditional Masques of Carnival." p.210.

Fancy Indian Chief⁵⁴



Figure 13 – Dame Lorainne
Photo of Dame Lorainne
Photo © www.guardian.co.tt

Reasons given by Green & Scher for this new “skimpy mas” aesthetic were the transformation of carnival into a street party, the decline of communities in producing mas, and the lack of involvement by masqueraders in the making of costumes. Based on Franco’s analysis of Crowley’s construction of traditional Trinidad carnival, this new aesthetic has resulted from two occurrences; first, the abundance of male traditional characters coupled with the current decline of male masqueraders in Trinidad carnival; and second, the deficiency of female traditional characters and the current dominance of female masqueraders in carnival today. According to Franco, these two occurrences have led to a decline in the presence of the traditional characters in carnival - because

⁵⁵ Ibid., p.208.

⁵⁴ Ibid., p.208.

they were mostly male - and the creation of a new aesthetic driven by those who currently dominate the parade in Trinidad Carnival, females. Franco calls for “a more balanced representation of gender in mas’ ” and speaks of “an obligation to select a more diverse array of traditional characters”.⁵⁶ This thesis builds on this argument, adding that there is a need for a more inclusive and diverse design process which allows participation by those of varying ages, gender, and capabilities.

Apart from the masculinization of the traditional characters of traditional carnival, before “skimpy mas” arrived, men accounted for “at least two-thirds of masqueraders and held the principal roles in participation in carnival”.⁵⁷ Today, women masqueraders are in the majority. As to whether women are also the majority in principal roles in carnival, needs to be looked into. My research addresses the male construction of traditional mas’ and its exclusion of females by focusing on the design process, not the character. Computation and digital technology has the ability to democratize design.

In Ruth Wuest’s paper entitled, *The Robber in the Trinidad Carnival* (1990), she writes about the Midnight Robber, one of the major traditional characters in Trinidad Carnival.⁵⁸ This character is steeped in the story-telling traditions of Trinidad and Wuest highlights its decline from the 1950’s to today. Based on an interview with a Midnight Robber on local television in February 1980, Wuest documents the materials used by

⁵⁶ Green and Scher, *Trinidad Carnival: The Cultural Politics of a Transnational Festival*. p.43.

⁵⁷ *Ibid.*, p.32.

⁵⁸ Wuest, “The Robber in the Trinidad Carnival.”

individuals to make Midnight Robber costumes. They used dyed flour bags, wire, and molds made from dirt and covered with paper, to construct their costumes. Wuest posits that the reduced appearance of the Midnight Robber in the Trinidad Carnival is due to the "rigid concept of the act".⁵⁹ Wuest's argument highlights the risk involved in tying culture to character, instead of tying culture to people and processes. How can computation aid in achieving culturally sustainability?

The Trinidad Carnival should no longer be tied only to characters, since this can exclude large sections of the demographic. It should instead be tied to processes, techniques, knowledge and skills to develop new forms, new ways of seeing and new ways of doing in design in the Trinidad Carnival. Michael J. Reddy in his paper entitled, *The conduit metaphor: A case of frame conflict in our language about language*, postulates that culture resides in people and the process, not in the product.⁶⁰ In this context of carnival, the product would refer to traditional characters. My position is that the culture of Trinidad Carnival does not reside in these characters, but instead in the people and the processes employed to produce the products. We harness our culture by documenting and passing it on to generations now, and in the future.

Raedene Copeland's PhD dissertation entitled, *Bikini, Beads, and Feathers at Trinidad Carnival: The Voice of the Younger Generation* (2010), investigates the meaning of the

⁵⁹ Ibid., p.52.

⁶⁰ Michael Reddy, "The Conduit Metaphor: A Case of Frame Conflict in Our Language About Language," in *Metaphor and Thought*, ed. Andrew Ortony (Cambridge: Cambridge University Press, 1993), 164–201.

“bikini and beads” aesthetic currently pervading Trinidad carnival.⁶¹ Through a series of interviews with masqueraders, designers, and managers, Copeland inquires about their participation and feelings, and impressions about Trinidad Carnival. Her work addresses the voices of the younger generation in the carnival experience. Copeland’s research concludes that the new aesthetic in carnival is “more than just ‘bikini, beads, and feathers’ [but that] it is an indicator of social values and attitudes toward dressing the body’ ”.⁶² She theorizes that the new aesthetic reflects a focus by designers on the younger generation of masqueraders.⁶³

In my analysis of the 34 participants selected for interviews with Copeland in her thesis, 62% (21 persons) were aged 35 or younger. 15% (5 persons) were between the ages of 36 and 50; and 19% (7 persons) were 51 years of age or older. Masqueraders formed 65% of her study (22 persons) whereas only 6% (2 people) were explicitly described as costume designers. Of the 21 people in the 35 and younger category, 86% of them (18 persons) were masqueraders, while only 1, was a costume designer. The small number of persons below the age of 35 who are involved in design in Trinidad Carnival is intriguing. The voices in her study were mainly participants in mas, not creators of mas. Copeland’s attention to the young masquerader is laudable; however, it seems to be based on an assumption that the younger generation of masqueraders is

⁶¹ Raedene P. Copeland, “Bikini, Beads, and Feathers|| at Trinidad Carnival: The Voice of the Younger Generation.” (PhD, The University of North Carolina at Greensboro, 2010).

⁶² Ibid., p.203.

⁶³ Masquerader - an individual who participates in the carnival parade

the only driver behind the “bikini and beads” aesthetic. There is a lack of “young” designers who were interviewed. Are the design approaches, practices, and processes in carnival, when coupled with the attitudes of the younger generation of masqueraders, causing this “bikini and beads” aesthetic? A more balanced look at the costume aesthetic from the perspective of a wider range and larger number of designers would have augured for stronger cementing of Copeland’s conjecture. Discovering this strengthens the need to carry out research into the state of the younger generation when it comes to making and designing in carnival. Copeland’s goal was to map out people’s experiences in carnival. Designers were asked about their motivation for creating costumes, challenges faced in meeting customer demands, and decision-making with respect to logistics and band organization. My research on the other hand seeks to uncover the processes, and knowledge of those involved in design in carnival.

Copeland concludes that the new aesthetic of bikini, beads, and feathers” is an indicator of social values and attitudes toward dressing the body, and that it represents the voice of the younger generation. Based on Franco’s analysis of Crowley, this “bikini and beads” aesthetic, has arisen from an exclusion of women in traditional mas and the dominance of them in contemporary mas. Green and Scher present the view that the aesthetic is a result of the decline of communities in producing mas, and the lack of involvement in the making of costumes by masqueraders. I would add to these

perspectives that the new aesthetic is an indicator of the lack of progress in the capturing and developing of design processes, skills, and knowledge in the Trinidad Carnival. A continued lacuna in this area risks the loss of knowledge, the development of new forms, new techniques, new knowledge, economic opportunities, and improvement in design in the Trinidad Carnival.

Some insights were obtained in this review of literature on the Trinidad Carnival. Its impact on the global cultural economy, its aesthetic transformations since the 1950's, and arguments on the preservation and development of traditional characters were brought to the forefront. Reasons for the presence of "skimpy mas" were given. They include the transformation of carnival into a street party instead of an event that demonstrates the "genius of the people," the decline of communities in producing mas, and masqueraders' lack of involvement in making costumes. Another explanation for the "skimpy mas" – bikini and beads aesthetic - was the large number of traditional male characters when currently mas is driven by female masqueraders. A final explanation for the aesthetic was that it was the voice of the younger generation, and an indicator of their attitude towards dressing the body. The reasons above are explained through history, communities, gender, and generation.

I believe the answer lies in design knowledge and processes. There is an absence in current knowledge about the design processes, knowledge, people, and practices in

carnival, as well as its contributions to design. This gap needs to be filled to understand the impacts Trinidad Carnival has had on design, and to develop support for the design process. This thesis will address this issue of the current aesthetic by focusing on (1) the people, processes, knowledge and practices in design in Trinidad Carnival, (2) the decline of communities and masqueraders in producing mas and costumes, and (3) the dying art of wire bending.

2.3.2 Computation, Digital Technology & Culture

This section explores existing research on the use of computation and digital technology in the form of shape grammars and digital fabrication to support cultural values. First, an overview of shape grammars and digital fabrication is given. Second, the use of shape grammars to capture and embed culture into the design of forms is offered. Third, the use of shape grammars and digital fabrication technology to embed cultural values through design features is made known. Finally, the power of using digital technology to inspire, and involve persons in “making” is illustrated. Collectively, the works presented support my research into the use of computation and digital technology to support culture in design.

Shape grammars are rules that apply in a step-by-step manner to generate or describe designs.⁶⁴ As figure 14 illustrates, they have been used in architecture, landscape design, furniture design, art, and product design.⁶⁵ In traditional architecture, it has been used in Turkey, Taiwan, Africa, Sarajevo, and Japan.⁶⁶ In most of these grammars, cultural values and beliefs are integral to the visual and spatial designs.

⁶⁴ Terry Knight, *Applications In Architectural Design, And Education And Practice*, Report for the NSF/MIT Workshop on Shape Computation (Massachusetts Institute of Technology, April 1999).

⁶⁵ José Pinto Duarte, "Towards the Mass Customization of Housing: The Grammar of Siza's Houses at Malagueira," *Environment and Planning B: Planning and Design* 32, no. 3 (2005): 347 – 380; U. Flemming, "More Than the Sum of Parts: The Grammar of Queen Anne Houses," *Environment and Planning B: Planning and Design* 14, no. 3 (1987): 323 – 350; G. Stiny and W. J. Mitchell, "The Grammar of Paradise: On the Generation of Mughul Gardens," *Environment and Planning B: Planning and Design* 7, no. 2 (1980): 209 – 226; T. Weissman Knight, "The Generation of Hepplewhite-style Chair-back Designs," *Environment and Planning B: Planning and Design* 7, no. 2 (1980): 227 – 238; T. W. Knight, "Transformations of De Stijl Art: The Paintings of Georges Vantongerloo and Fritz Glarner," *Environment and Planning B: Planning and Design* 16, no. 1 (1989): 51 – 98; M. Agarwal and J. Cagan, "A Blend of Different Tastes: The Language of Coffeemakers," *Environment and Planning B: Planning and Design* 25, no. 2 (1998): 205 – 226.

⁶⁶ G. Cagdas, "A Shape Grammar: The Language of Traditional Turkish Houses," *Environment and Planning B: Planning and Design* 23, no. 4 (1996): 443 – 464; S.-C. Chiou and R. Krishnamurti, "The Grammar of Taiwanese Traditional Vernacular Dwellings," *Environment and Planning B: Planning and Design* 22, no. 6 (1995): 689 – 720; T. Herbert, I. Sanders, and G. Mills, "African Shape Grammar: a Language of Linear Ndebele Homesteads," *Environment and Planning B: Planning and Design* 21, no. 4 (1994): 453 – 476; Birgul Colakoglu, "Design by Grammar: An Interpretation and Generation of Vernacular Hayat Houses in Contemporary Context," *Environment and Planning B: Planning and Design* 32, no. 1 (2005): 141 – 149; T. Weissman Knight, "The Forty-one Steps," *Environment and Planning B: Planning and Design* 8, no. 1 (1981): 97 – 114.

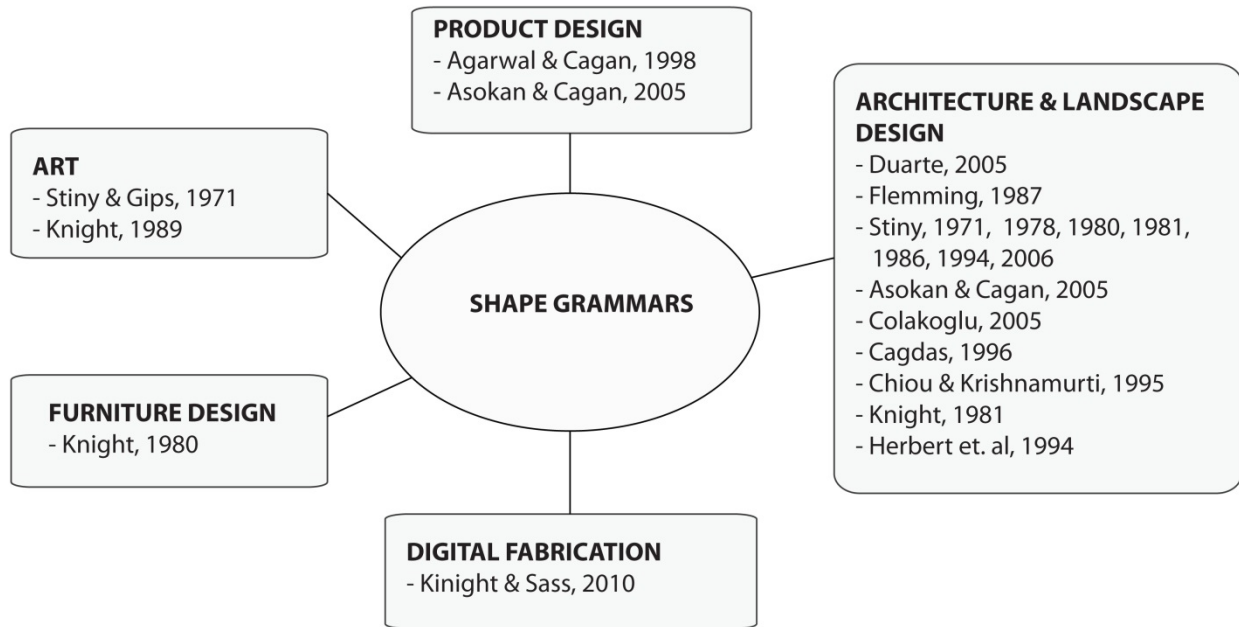


Figure 14 - Areas where Shape Grammars have been used

Digital fabrication according to Dianna Pfeiffer (2009) is the making of physical objects through the use of computer-controlled tools.⁶⁷ This includes the fabrication of nearly all products surrounding us that are at a scale than can be manufactured by CAD/CAM machines. Examples include clothing, and cars. Neil Gershenfeld (2012) defines digital fabrication as the ability to turn data (digital) into the physical, and the physical into the digital.⁶⁸ Digital Fabrication is rapidly growing in the fields of architecture, and wearables (Francis Bitonti, Iris Van Herpen, Jiri Evenhuis & Janne Kyttanen, and Neri Oxman).⁶⁹ The prime means of exploration of digital fabrication in wearables, however,

⁶⁷ Diane Pfeiffer, "Digital Tools, Distributed Making & Design" (Master of Science in Architecture, Virginia Polytechnic Institute and State University, 2009).

⁶⁸ Neil Gershenfeld, "How to Make Almost Anything - The Digital Fabrication Revolution," *Foreign Affairs* 91, no. 6 (December 2012).

⁶⁹ Lawrence Sass and Marcel Botha, "The Instant House:A Model of Design Production with Digital Fabrication," *International Journal of Architectural Computing* 4, no. 4 (December 1, 2006): 109–123;

has been through the use of 3D printing technologies. My thesis at this present time will explore the use of laser cutting technology in design prototyping for artifacts in the Trinidad Carnival.

Asokan & Cagan in their conference paper entitled, *Defining cultural identities using grammars: an exploration of "cultural languages" to create meaningful experiences* (2005) develops support for cultural values using the computational tool, shape grammars.⁷⁰ Shape grammars proved a successful tool in their research because it aided in translating cultural context (qualitative) into quantitative information. Asokan & Cagan analyzed the values, interactions, and artifacts that to them explained the reasoning and significance of Southern Indians' behaviors and actions. Using classical South Indian dance as a foundation, they studied the movements of people involved in coffee-making since to them this dance reflected the traditions and value systems of the people. Shapes were then created from these movements, and defined as the shape vocabulary in their movement grammar. This process of creating shapes from these movements was the manner in which cultural language was converted into design

Lawrence Sass, "Synthesis of Design Production with Integrated Digital Fabrication," *Automation in Construction* 16, no. 3 (May 2007): 298–310; "Brooklyn Architect Creates 3D-Printed Dress for Dita Von Teese - Fort Greene - DNAinfo.com New York," *DNAinfo*, accessed July 9, 2013, <http://www.dnainfo.com/new-york/20130319/fort-greene/brooklyn-architect-creates-3d-printed-dress-for-dita-von-teese>; Groninger Museum, *Iris Van Herpen*, Bilingual (EXHIBITIONS INT'L, 2012); "Freedom Of Creation | FOC Textiles in Permanent Collection at MOMA | Pioneers in 3D Printed Designs," accessed July 9, 2013, <http://www.freedomofcreation.com/home/foc-textiles-to-permanent-collection-at-moma>.

⁷⁰ Ashwini Asokan and Jonathan Cagan, "Defining Cultural Identities Using Grammars: An Exploration of 'Cultural Languages' to Create Meaningful Experiences," in *Proceedings of the 2005 Conference on Designing for User eXperience*, DUX '05 (New York, NY, USA: AIGA: American Institute of Graphic Arts, 2005).

language. This movement grammar then informed the design of coffee tumblers and cups so that they reflected what Asokan & Cagan thought were core cultural values in Southern India. Culture was embedded in the grammar, resulting objects, and designs. Their research supports my study into the deployment of shape grammars to support cultural design values.

Knight & Sass in their paper entitled, *Looks count: Computing and constructing visually expressive mass customized housing* (2010) introduce new research that attempts to embed vernacular design features into components for residential structures, through digital fabrication.⁷¹ They seek to address the importance of cultural language and expression by using computation and digital technology. In this case, Knight & Sass use shape grammars and digital fabrication, to address the expression of cultural values in architecture at the scale of housing.

In their studies, 2D visual designs defining a vernacular language were interpreted into 3D physical components for assembly. These vernacular languages included "kolam designs from India, litema designs from South Africa, and meander designs from Greece".⁷² The kolam designs have significant cultural value to the people of Tamil Nadu. By using computations, new, hypothetical kolam designs were created. These 2D

⁷¹ Terry Knight and Larry Sass, "Looks Count: Computing and Constructing Visually Expressive Mass Customized Housing," *Artificial Intelligence for Engineering Design, Analysis and Manufacturing* 24 (2010): 425–445.

⁷² *Ibid.*, p.429.

computations of new designs were then materialized into 3D using digital fabrication technologies (3D printing). This theoretical approach is but the beginning of embedding visual vernacular design features in building components. For the meander designs, 2D design variations generated from a shape grammar was transformed into “3D building components of a double-wall system”.⁷³ Visual and structural integrity was designed into these interlocking components which were also materialized by 3D printing.

These studies demonstrate the ability to employ shape grammars and digital fabrication to embed visual vernacular design features into components such that there is cultural specificity in designs. My research seeks to use shape grammars to capture the cultural practice of wire bending, analyze an existing corpus of costume designs, and create new, hypothetical designs for costuming in the Trinidad Carnival. I then use digital fabrication processes to materialize potential designs for the creation of 3D “objects to think with” in design.

Some insights were acquired in my review of literature on the use of computation and digital technology to support cultural values and practices. Firstly, shape grammars can be used to capture and embed cultural language into design language. Secondly, shape grammars can be used to embed visual design features into 3D components with digital fabrication technologies. However, within these areas of application of computation and digital technology, an opportunity was discovered. The opportunity to explore the

⁷³ Ibid., p.440.

application of shape grammars and digital fabrication tools in the design of artifacts to be worn, supported, and performed by the human body at the scale that resides between architecture and wearables.

2.3.3 Things and Thinking

This section presents work on the power of objects – “evocative objects” – and how we can interact, learn, and imagine through them.⁷⁴ My thesis aims to look into the use of shape grammars and digital fabrication technology to create “objects to think with” in design. These objects will serve as tools to help persons learn, and see things in new ways.

In Sherry Turkle's book, *Evocative Objects: Things We Think With* (2007), Mitchel Resnick in his essay, *Stars*, tells us about his fascination with objects and their use in education.⁷⁵ Resnick tells us of his fascination with stars, and an object his teacher showed him in class. The object comprised of two wheels with an axle, a pin hanging from the middle of the axle, and a string at the pin's end. Resnick loved stars, but “this object was different [...] you could hold it in your hands and test it out”.⁷⁶ So inspired by this object, he made a similar object of his own to test questions he had about Physics. This object gave him ways and means to understand concepts in Physics. He

⁷⁴ Sherry Turkle, *Evocative Objects: Things We Think with / Edited by Sherry Turkle* (Cambridge, Mass. : MIT Press, c2007., 2007).

⁷⁵ Ibid.

⁷⁶ Ibid., p.41.

visualized possibilities with this object, and used it to learn new areas of Physics, in a new way. Today, Resnick uses the computer to create evocative objects for people to “learn new things in new ways”.⁷⁷ I would also like to point out that Mitch was so inspired by the object in class that he made his own object. Not only was the object a way for him to learn new things, but it also motivated him to MAKE.

Jean Piaget in *Genetic Epistemology* (2007), theorized that human knowledge was active and that by constructing systems of transformations on or with objects, knowledge was constructed.⁷⁸ These actions of interacting with objects in a physical and/ or mental way enable reflective thinking, and knowledge construction. I posit that using computational tools and digital technology - shape grammars and digital fabrication - to create “objects to think with” in the design process, will improve design. Digital and physical objects can be acted upon by individuals, engaging mental calculations, sensory perceptions and motor activities.

Seymour Papert in his book, *Mindstorms: Children, Computers, and Powerful Ideas* (1993), in the chapter titled, *The Gears of My Childhood*, explains to us how an object – in his case gears, served as mental and physical models to help him understand

⁷⁷ Ibid., p.43.

⁷⁸ Jean Piaget, *Genetic Epistemology*. Translated by Eleanor Duckworth, Woodbridge Lectures Delivered at Columbia University in October of 1968, No. 8 (New York, Columbia University Press, 1970., 1970).

abstract ideas.⁷⁹ Gears were his evocative objects, his “objects to think with”. It was this object that enabled him to engage with the world, and the world of mathematics.

Carol Strohecker in her essay *Knots*, talks about her love of knots, and having fun with them.⁸⁰ She “generated [...] designs”, “calculated lengths”, mastered physical maneuvers, “learned to see things” and imagine with these knots.⁸¹ Sometimes she embellished existing designs, other times she created her own designs. This combination of mental and physical processes (thinking and action), constructed active learning and gave immediate feedback to her on the consequences of her design decisions. In her lab, Strohecker observed students working with these knots, and realized that these objects were helping her students think and learn. Students had different approaches to knotting. Some would have a step-by-step approach, others a combination of steps, and yet others would interact with the knots as an “integral entity”.⁸² Shape Grammars can be used for analysis and synthesis in design; and the ability to create to test, calculate, analyze and synthesize design knowledge is an extremely powerful one.

⁷⁹ Seymour Papert, *Mindstorms: Children, Computers, and Powerful Ideas / Seymour Papert* (New York : Basic Books, c1980., 1980).

⁸⁰ Sherry Turkle, *Evocative Objects: Things We Think With* (MIT Press, 2007).

⁸¹ Turkle, *Evocative Objects*, 2007., p.24.

⁸² *Ibid.*, p.25.

2.4 Summary of Background

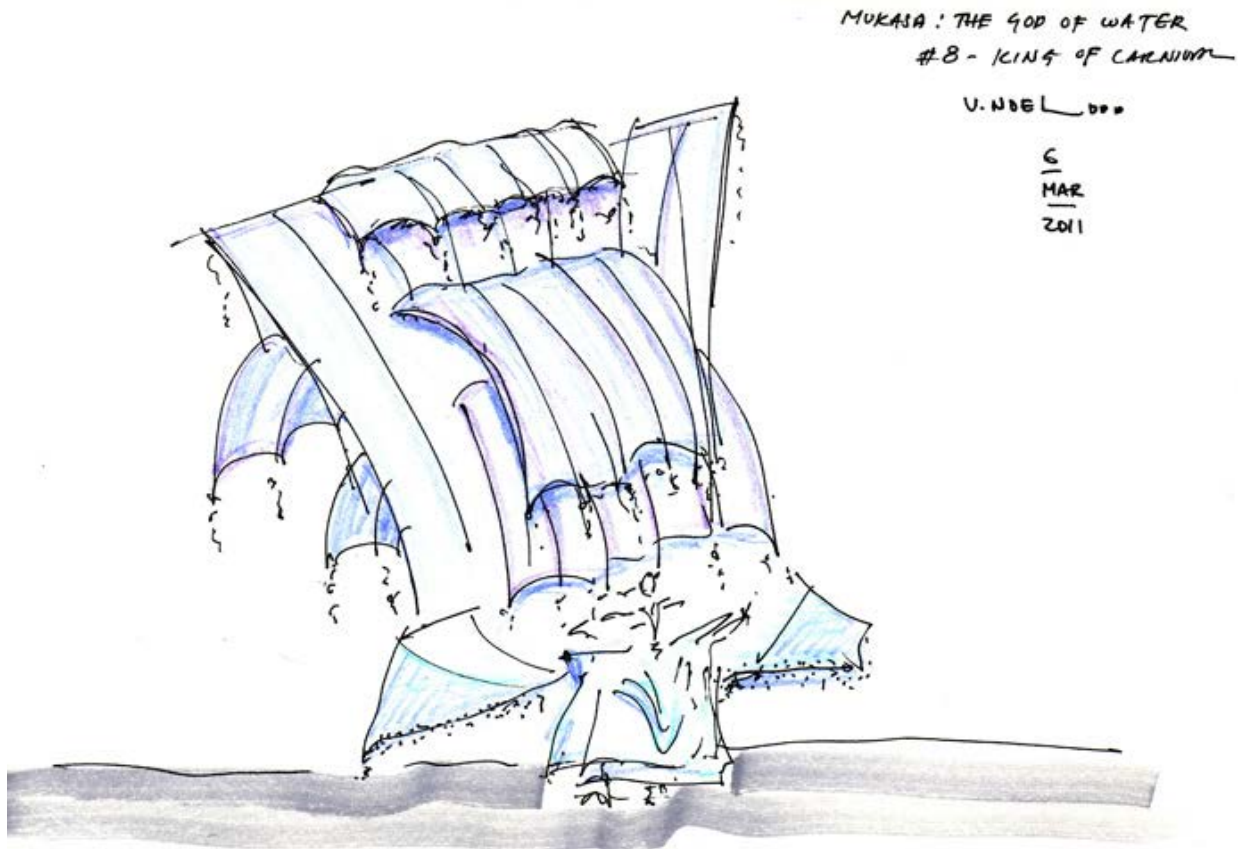
In this chapter I gave insight into the Trinidad Carnival, which was a means of celebration of freedom and a creative outlet by former slaves. I then discussed the strong impact the Trinidad Carnival has had on the global cultural economy; and its aesthetic transformations since the 1950's. I also presented some of the reasons given for the current "skimp mas" aesthetic in the Trinidad Carnival. They included the decline of communities in producing mas, masqueraders' lack of involvement in making costumes, the masculinization of mas', and an indicator of the younger generation's attitude towards dressing the body.

In my review on the use of computation and digital technology to support cultural values, I highlighted studies that applied computational tools in the design and production of artifacts that were informed by culture. Shape Grammars were used to capture visual design features and movement that defined a culture. These grammars were then used to generate designs and fabricate artifacts to express culture visually, and through form generation. In my analysis of the use of "object to think with", I highlighted the power of objects (gears and knots, for example) to assist us in constructing knowledge, and learning new things in new ways. By using Shape Grammars and digital fabrication tools, we can generate alternative designs, and create "objects to think with" in the design process in the Trinidad Carnival.

Chapter 3:

Analysis

- 3.1 Activity System
- 3.2 Models
- 3.3 Chapter Summary



Drawing © Vernelle A. A. Noel 2011

3 Analysis

For my understanding of the existing situation in design in the Trinidad Carnival, I used the DRM Research Methodology and Engestrom's activity system to analyze design activity. By carrying out field research, interviews, observations, and participating in the design process, I developed models describing the existing and desired situation. Based on this analysis and understanding I would develop support for the design process.

3.1 Activity System

In this thesis, I adapt Engestrom's Activity System model to suit design in the context of Trinidad Carnival. One of the objectives of design activity in the Trinidad Carnival is for those involved in the activity (subjects) to showcase their creativity. In order to achieve this object(ive), mediating artifacts such as tools and methods are used by subjects. The subject's position is influenced by rules, the community, and the division of labor.⁸³ Figure 15 illustrates the components of the activity of design in carnival.

⁸³ Joanne Hardman, "Researching Pedagogy: An Activity Theory Approach," *Periodical of the Kenton Education Association* (n.d.): 65, accessed May 26, 2013.

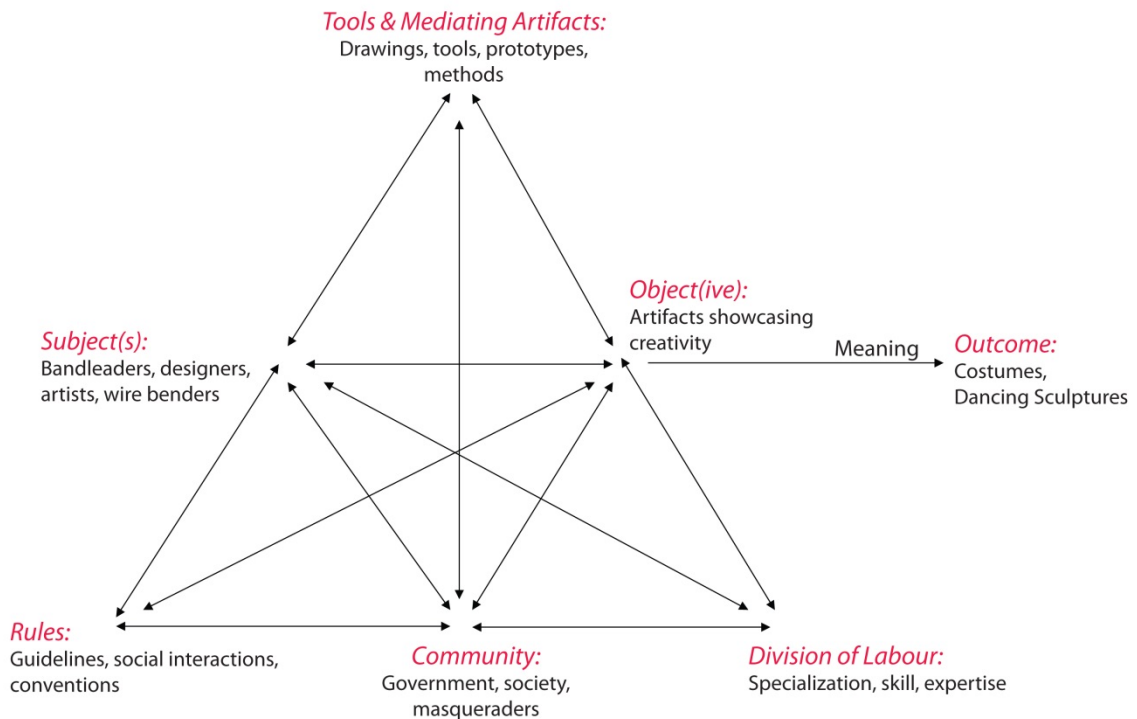


Figure 15 - Trinidad Carnival explained using Activity System model

3.1.1 Subjects

Subjects in the context of the Trinidad carnival are individuals and groups who are involved in the design process. They include bandleaders, designers, artists, prototypists, wire benders, and the production team.

3.1.1.1 Bandleaders

Bandleaders finance and make financial decisions for the production of their carnival bands. Their duties include seeking sponsorship and funding for purchasing materials, paying staff, renting space for their Mas Camp, and marketing. They may or may not be

involved in making creative decisions about the designs for their band. Examples of bandleaders include Roland St. George, Peter Minshall, Stephen Derek, George & Albert Bailey, Wayne Berkeley, and Brian Mac Farlane.

In addition to financing and designing, a bandleader may also perform creations from their Mas Camp. Roland St. George (Fig. 16) is an example of this kind of bandleader. St. George develops design ideas, structural designs, constructs his Kings of the Band (dancing sculptures), and performs them in competitions. Figure 17 is a photograph of a King of the Band performed and designed by Roland St. George and his team.



Figure 16 - Bandleader, Roland St. George
Bandleader, Roland St. George showing design
done by Robert Miller in front of him.
Photo © Vernelle A. A. Noel 2013



Figure 17 – Roland St. George King of the Band
Roland St. George's dancing sculpture
Photo of photo taken at D'Krewe Mas Camp
© Vernelle A. A. Noel 2013

As performer and designer of his dancing sculptures, St. George is chiefly concerned with the dancing sculpture's visual quality, movement, and its structural stability. "It takes great skill to dance something 20' tall with the human body," Roland tells me during our interview.⁸⁴ Design and production of dancing sculptures in Carnival requires different skills such as engineering, fashion design, and wire bending, all with the goal of bringing the dancing sculpture to life! Bandleader, Peter Minshall (Fig. 18) was heavily involved in every aspect of his productions, from designing costumes and dancing sculptures (Fig. 19) to designing the parade and choreography. However, unlike Roland St. George, Minshall did not perform his dancing sculptures.



Figure 18 – Peter Minshall

Interview by Vernelle A. A. Noel with Peter Minshall
Photo © Vernelle A. A. Noel 2013



Figure 19 – "Iron Bat" © Peter Minshall
Photo © Callaloo Company

Stephen Derek is a bandleader, wire bender (Fig. 20), designer (Fig. 21), and artist. He has been involved in design in carnival for over 50 years, and was taught by the Bailey

⁸⁴ Roland St. George, Interview by Vernelle Noel, Personal interview, Trinidad, January 6, 2013.

Brothers.⁸⁵ George Bailey was the designer and part of the Golden Age of the Masquerade, Alvin Bailey was the artist, and Albert Bailey is a premiere wire bender.⁸⁶



Figure 20 – Stephen Derek
Stephen Derek – Bandleader, Designer,
and Wire bender
Photo © Vernelle A. A. Noel 2013

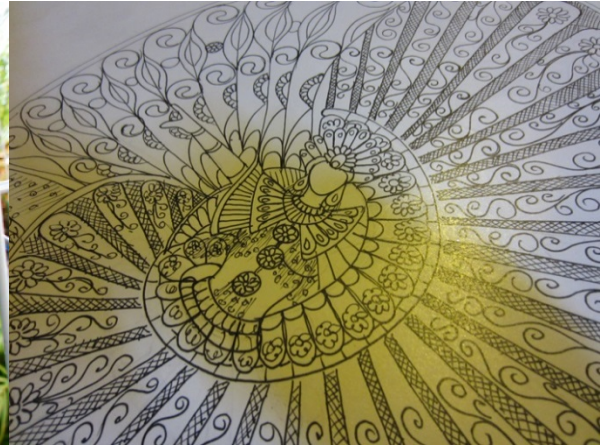


Figure 21 – Design of costume
Drawing and design for costume
by Stephen Derek
Photo © Vernelle A. A. Noel 2013

From my analysis, bandleaders finance the production, acquire teams with skill-sets needed to accomplish objectives, obtain space for their Mas Camp, and market their productions to the public. They may be involved in designing, artwork, and performing their dancing sculptures.

3.1.1.2 Designers

Designers create costumes and artifacts for carnival. They are responsible for generating ideas for the theme of the band, section names, design elements, materials, techniques, and colors of band sections. Designer, Peter Minshall, produced detailed

⁸⁵ Stephen Derek, Interview by Vernelle Noel; Schechner, Riggio, and Minshall, "Peter Minshall."

⁸⁶ Albert Bailey, Interview by Vernelle Noel, Personal interview, Trinidad, January 3, 2013.

drawings and built prototypes as part of his design process. As for his design approach, he said, "I do not design costumes; I try to find ways and means for the expression of human energy... both spiritual and physical energy."⁸⁷ Robert Miller (Fig. 22) is a triumvirate of designer, artist and bandleader. He designs costumes and dancing sculptures for carnivals in Trinidad and abroad. As a young boy looking at the bands in carnival, Miller tells me it "woke up the creativity in me...and created an interest in me to get involved in mas making... I would look at everything!"⁸⁸



Figure 22 – Robert Miller
Interview by Vernelle A.A. Noel with Robert Miller
Photo © Vernelle A. A. Noel 2013

Liselle Astread Frauenfelder (Fig. 23) is a young designer at Roland St. George's Mas Camp. She gets excited when she thinks about seeing her designs materialized (Fig. 24). Frauenfelder tells me, "The making of the mas is what's important to me... [the]

⁸⁷ Peter Minshall, Interview by Vernelle Noel, Personal interview, Trinidad, January 11, 2013.

⁸⁸ Robert Miller, Interview by Vernelle Noel, Personal interview, Trinidad, January 9, 2013.

putting together [of] the costumes. Carnival Monday and Tuesday is the showcase.”⁸⁹

The design process and seeing the results of her work, drives her.



Figure 23 - Liselle Frauenfelder
Liselle Astread Frauenfelder showing her designs and sketches for costumes in Carnival
Photo © Vernelle A. A. Noel 2013



Figure 24 – Liselle’s sketches
Liselle showing her designs of costumes
Photo © Vernelle A. A. Noel 2013

From my analysis, designers generate ideas for the concept, theme, and story of the band. They determine design elements, materials, and colors for carnival artifacts. They may also design the parade and performances for competitions.

3.1.1.3 Artists

An exciting aspect in Trinidad carnival is the public presentation of sketches of costume designs at the Mas Camps. Potential masqueraders visit Mas Camps to see the designs, then decide which band and in which section they would “play.” Artists produce these sketches and renderings for display, and also assist in choosing the color palette for

⁸⁹ Liselle Frauenfelder, Interview by Vernelle Noel, Personal interview, Trinidad, January 9, 2013.

costumes. Designers or bandleaders may hire artists to produce renderings of their designs, and in some cases, the artist may decide on the color palette for the costumes. James Hackett is an artist, and produced renderings for the Mas Camp, SoBeIt, in 2013. Hackett has a background in fashion design and experience in design for mas'. He chose the color palette for SoBeIt's costumes and produced artwork that was "descriptive but not too detailed."⁹⁰ This artwork was passed on to prototypists to build the designs. Minshall, Miller, and Derek produce their own artwork for public display.

3.1.1.4 Prototypists

Prototypists are responsible for transforming 2D artwork into 3D through construction. They work out construction techniques and compositions to best realize the designer's intent. Designers discuss their ideas and intentions with prototypists using tools and mediating artifacts such as sketches, to bring their ideas to a reality.⁹¹ Robert Frederick, prototypist for SoBeIt (Fig. 25 and 26), translated the artwork of artist, James Hackett, (Figures 49, and 50) into physical 3D prototypes. Frederick interpreted materials, construction techniques, and materials that would achieve the visual quality, and desired movement of costumes.

⁹⁰ James Hackett, Interview by Vernelle Noel, Skype Interview, March 4, 2013.

⁹¹ Anthony Tang Kai, Interview by Vernelle Noel, Personal interview, Trinidad, December 28, 2012.



Figure 25 – Robert Frederick
Robert Frederick testing one of his prototypes
Photo © Vernelle A. A. Noel 2013



Figure 26 – Pattern Making
Robert Frederick cutting patterns and sewing
prototypes
Photo © Vernelle A. A. Noel 2013

Frederick remarks, “Different artists and designers see different things when going from 2D to 3D. Every design comes with its own challenges.”⁹² This was evident when in one meeting that I sat in on, Frederick (prototypist) and the designer had different interpretations of the artist’s work. Prototypists use techniques such as wire bending, pattern-making, sewing, and mold making to transform 2D representations into 3D.

3.1.1.5 Wire Benders

Wire bending is a traditional art form in the creation of costumes and dancing mobiles in the Trinidad Carnival. Wire and other thin, flexible strands of material such as fiber glass rods, and cane are bent and assembled to create forms and structure for

⁹² Robert Frederick, Interview by Vernelle Noel, Personal interview, Trinidad, December 29, 2012.

costumes.⁹³ The resulting artifacts are then decorated for competitions and parades (Fig. 28). Wire bending began in the late 1930's and 1940's in the Trinidad Carnival to make 2D forms for traditional characters like Sailors (Fig. 10), Fancy Indians (Fig. 11), and the Midnight Robber. In the 1950's however, the experimentation of wire bending techniques to create three dimensional forms developed. Albert Bailey (Fig. 27) was a part of this period. Before the advent of wire bending, papier mache and cardboard were used to make 3D forms in the Trinidad Carnival.⁹⁴



Figure 27 – Albert Bailey
Albert Bailey – Wire bender in Trinidad Carnival
Photo © Vernelle A. A. Noel 2013



Figure 28 –Costume by Albert Bailey
Structure created from wire bending. Photo
of costume after it has been decorated
Photo © Vernelle A. A. Noel 2013

⁹³ Albert Bailey, Interview by Vernelle Noel, Personal interview, Trinidad, January 4, 2013.

⁹⁴ Albert Bailey, Interview by Vernelle Noel, Telephone Interview, July 2, 2013; Wuest, "The Robber in the Trinidad Carnival."



Figure 29 – Wire bent structure for costume Backpack structure created from aluminum flats, and rods by Stephen Derek
Photo © Vernelle A. A. Noel 2013



Figure 30 - Wire bent form
Wire bent form built by Stephen Derek
Photo © Vernelle A. A. Noel 2013

Figures 29 and 30 are photos of wire bent sculptures made by Stephen Derek at his Mas Camp in Woodbrook, Trinidad.



Figure 31 – Making backpack for kids' costume
Photo © Vernelle A. A. Noel 2013



Figure 32 - Backpack for kids' costume
Photo © Vernelle A. A. Noel 2013

Figures 31 and 32 are photos illustrating the making of the back pack used to carry the costumes, in this case, by kids.

3.1.1.6 Production Team

The duties of the production team include decorating, assembling, sewing, painting, and molding (Fig. 33, 34, and 35). They are responsible for producing finished carnival artifacts for masqueraders and competitions. A production manager may be responsible for training individuals and quality control of the process and resulting costumes.

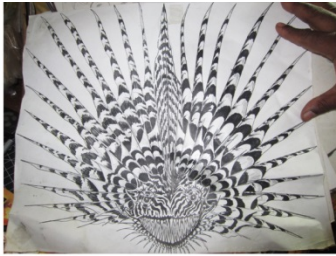


Figure 33 – Production Staff
People working at Mas Camps
Photo © Vernelle A. A. Noel 2013



Figure 34 – Production Staff
People working at Mas Camps
Photo © Vernelle A. A. Noel 2013

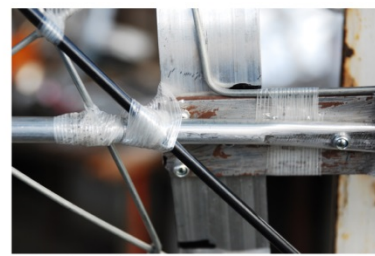
3.1.1.7 Activities engaged in by subjects



Design & Design Representation



Papier Mache



Wire bending



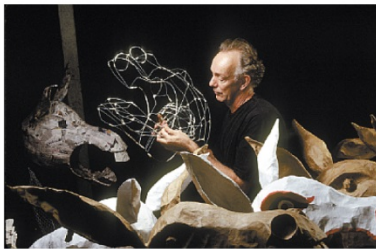
Constructing artifacts from metal



Jigs used by some for wire bending



Wire bending



Prototyping



Painting/ coloring fabric



Covering headpieces



Airbrushing & Painting



Welding



Cane manipulation



Pattern making



Sewing

Figure 35 – Design Activities in Carnival
Activities engaged in by Subjects in design in carnival
Photos © Vernelle A. A. Noel 2013

3.1.2 Object(ive)s

Object(ive)s in activity systems are the products that are transformed by, the result of, and a representation of the (design) activity. In the context of design in carnival, object(ive)s include costumes (Fig. 36, 37, 38, and 39), dancing sculptures, and the masquerade.

3.1.2.1 Costumes



Figure 36 – Costume on display
Costume for SoBeIt 2013 at Mas Camp
Photo © Vernelle A. A. Noel 2013



Figure 37 – Marketing of costume
Costume by SoBeit 2013
© SoBeit



Figure 38 – Costume display
Display of costume at Brian Mac Farlane's
Mas Camp
Photo © Vernelle A. A. Noel 2013



Figure 39 – Costume display
Display of costume at Brian Mac Farlane's
Mas Camp
Photo © Vernelle A. A. Noel 2013

3.1.2.2 Dancing Sculptures

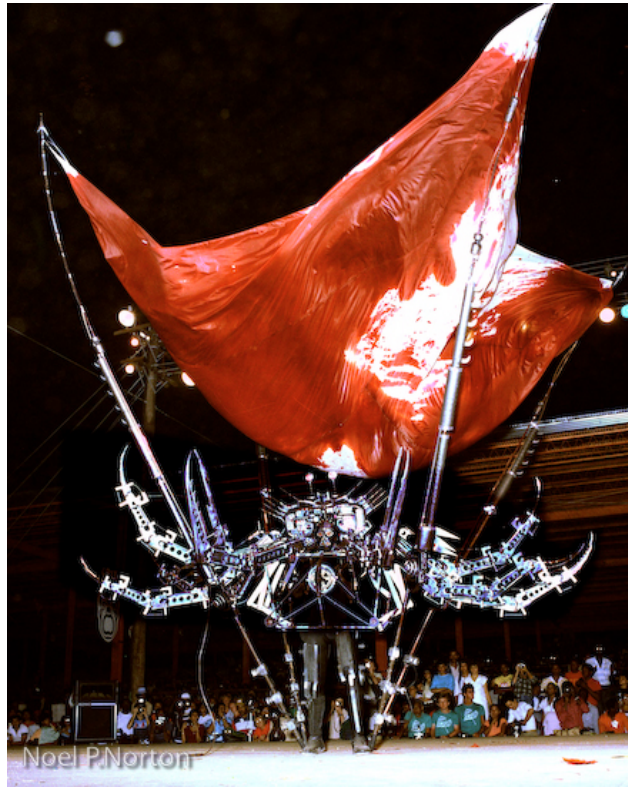


Figure 40 – King of the band
Mancrab on stage at Dimanche Gras, 1983
© Photo by Noel P. Norton

Dancing sculptures, also called “dancing mobiles” or “walking sculptures” by Peter Minshall, are large, self-supported, structural artistic creations that may be up to 25 feet wide and 18 feet tall.⁹⁵ Dynamism, color, theatrics, materials, construction technique and creativity, are just some of the important components of dancing sculptures. They serve as body extensions, coming alive when the masquerader dances (Fig. 40, 41, and 42), and are carried solely by the performer or assisted by a maximum of three wheels, as per competition rules.

⁹⁵ Schechner, Riggio, and Minshall, “Peter Minshall.” p.187.



Figure 41 - King of the band
Ted Eustace, "Moko in Flames" - 2013
Photo © <http://studiolafoncette.com/>



Figure 42 - King of the band
'Spirits of Mandingo-An African Legend - 2010
Photo © <http://bandwagonist.wordpress.com>

3.1.2.3 Parade/ Masquerade



Figure 43 – Masqueraders on the competition stage
"Danse Macabre" - Peter Minshall (1980)
Photo © Callaloo Company



Figure 44 - Masqueraders
"Papillion" - Peter Minshall (1982)
Photo © Callaloo Company

Months of long preparation and excitement for carnival, culminates into an explosion of people, costumes, and music in the city (Fig. 43, and 44).

3.1.3 Tools & Mediating Artifacts

Tools and mediating artifacts refer to instruments, models, drawings, prototypes, and procedures used to transform and shape object(ive)s. Tools and artifacts mediate between the subjects and the object(ive)s, and influences the way people think, act, and interact with each other and the object(ive)s. They have an effect on the activity, and are too altered by the activity. The current tools and materials used in design activities in the Trinidad Carnival affects the resulting object(ive)s, the thinking of those using these mediating artifacts, and their interactions with each other. The introduction of computational tools in design activities in carnival will also alter the way people involved act and interact their thinking, and the object(ive)s. It can allow computational thinking. This is not a one-way street, as these computational tools will also be altered due to their application in design in carnival.⁹⁶

3.1.3.1 Drawings and Artwork

In my analysis, drawings were primarily done by hand on paper, and rendered with colored pencils, markers, and paints (Fig. 45, 46, 47, 48, 49, and 50).

⁹⁶ David H. Jonassen and Lucia Rohrer-Murphy, "Activity Theory as a Framework for Designing Constructivist Learning Environments," *Educational Technology Research and Development* 47, no. 1 (March 1, 1999): 61–79.

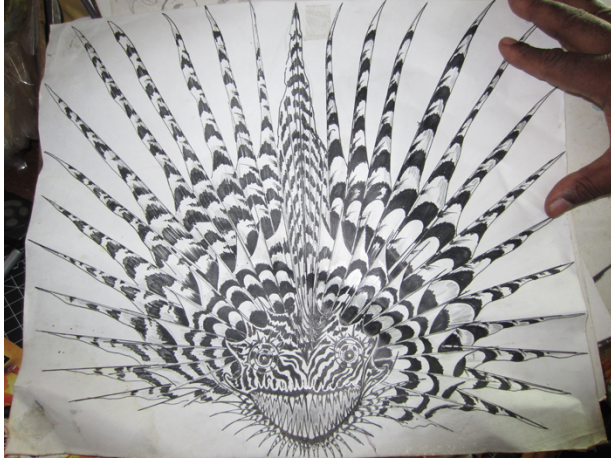


Figure 45 – Drawing of King of the band Design and artwork of King of Carnival by Robert Miller
Photo © Vernelle A. A. Noel 2013



Figure 46 – Drawing of Costume Design and artwork of King of Carnival by Robert Miller
Photo © Vernelle A. A. Noel 2013



Figure 47 – Artist rendering of Costume Sanctification (2012)
Artwork © Brian Mac Farlane



Figure 48 – Artist rendering of Costume Sanctification (2012)
Artwork © Brian Mac Farlane

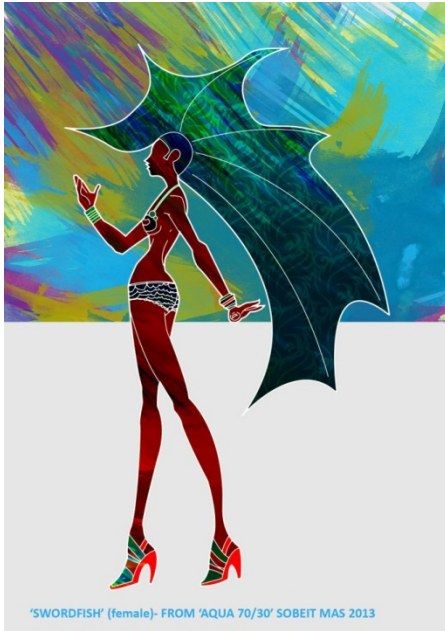


Figure 49 - Artist rendering of Costume
Aqua 70/30 (2013)
Artwork © James Hackett

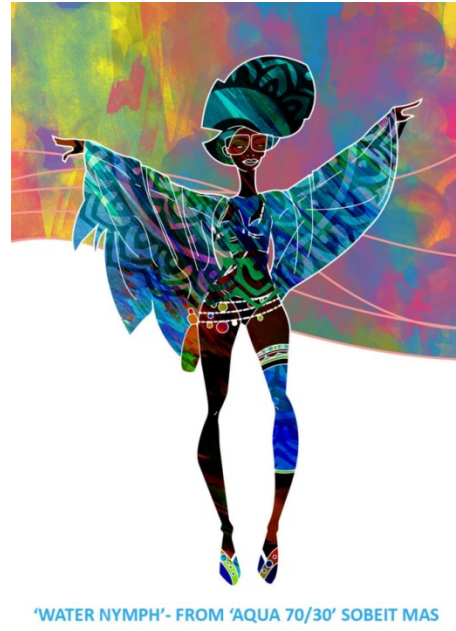


Figure 50 - Artist rendering of Costume
Aqua 70/30 (2013)
Artwork © James Hackett

The artist for SoBelt – James Hackett - used both traditional and digital media for his artwork. His initial sketches on paper were scanned and converted to a digital file and developed with Digital creative software on his computer. The representations were used for public display and marketing (Figures 49 and 50).

3.1.3.2 Wire Bending

Wire bending is a unique, traditional art form used in the design and construction of costumes and dancing sculptures in the Trinidad Carnival. This art form is currently undocumented, tacit knowledge. Tacit knowledge is referred to by Polanyi & Prosch

(1958) as an unknown set of rules.⁹⁷ It resides in someone, and is many times difficult to explain, verbalize, communicate, or formalize into a system of symbols with which humans are familiar⁹⁸. Explicit knowledge on the other hand is transferrable, that is, it can be captured using symbols and text and shared with others. My thesis seeks to formalize aspects in wire bending into a system of symbols and text that can be shared with others.

3.1.3.3 Tools

The majority of tools observed in the design and production of Trinidad carnival were hand tools (Fig. 51). Some of these tools included: hacksaws, hammers, glue guns, rivet guns, sewing machines, jigs, scissors, pliers, files, paint brushes, and drills. These tools influence the process, and the introduction of computational tools will also influence the current process, and be changed by the process.

⁹⁷ Michael Polanyi, *Personal Knowledge: Towards a Post-Critical Philosophy*, Corr. Ed (University Of Chicago Press, 1974).

⁹⁸ Harry Collins, *Tacit and Explicit Knowledge* (University Of Chicago Press, 2010).



Tape, Hacksaw, Hammer, Tape



Hammer



Colored pencils, glue gun



Aluminum flats, fiber glass rods



Hammer, sturdy flat surfaces



Pneumatic rivet gun



Sewing machine



Wood pieces used in copper repousse



Drill, sanding machine



Jigs for wire bending



Scissors



Square, pliers, file



Pliers, gloves



Airbrushing equipment



Paints

Figure 51 – Tools employed in design process

Tools used in the design process in Trinidad Carnival

Photos © Vernelle A. A. Noel 2013

3.1.3.4 Prototypes

Prototypes are built to test construction techniques, assembly, materials, scale, and the visual quality of costumes and other artifacts in the Trinidad Carnival. They enable feedback on design decisions (Fig. 52, and 53). Due to the labor intensive methods of costume construction in the Trinidad Carnival, prototyping takes up a large amount of time and resources in the design process. This was stressed by Bailey who said, “Prototyping takes all the energy out of you, [...] and the wire [also].”⁹⁹ Prototypes are most times done at the full scale.



Figure 52 - Prototyping
Prototypes of painted fabric and decorating
elements for costumes
Photo © Vernelle A. A. Noel 2013

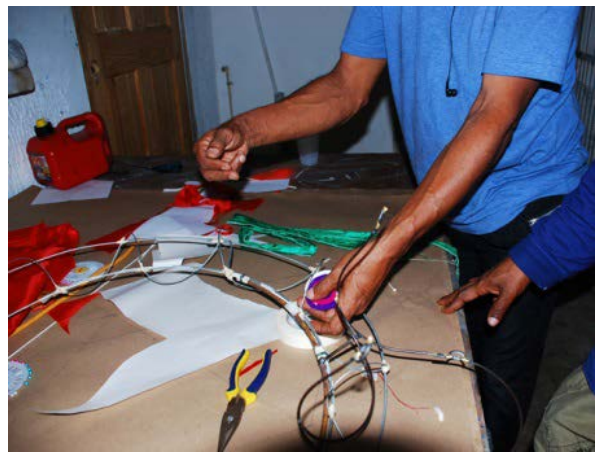


Figure 53 - Prototyping
Discussing the best construction method for a
design element with prototype
Photo © Vernelle A. A. Noel 2013

⁹⁹ Albert Bailey, Interview by Vernelle Noel, January 4, 2013.

3.1.3.5 Design Methods & Processes

In the following section I give case studies of design processes by three different Designers and Mas Camps. The first is Peter Minshall's 1983 carnival production, entitled, "River" (Fig. 54, 55, 56, 57, and 58). The synthesis of his design process is informed by my interview with Minshall's creative collaborator, Todd Gulick, literature, and the documentary, "Mas Man" by Dalton Narine.¹⁰⁰ Secondly, I illustrate the design process for SoBelt's 2013 carnival production, entitled, "Aqua 70/30" (Fig. 61, 62, and 63). This analysis is based on my interviews with Robert Frederick, James Hackett, and Lari Richardson, my observations, and participation at the Mas Camp.¹⁰¹ The final case study is the design process for Brian Mac Farlane's 2013 carnival production, "Joy – The Finale" (Fig. 66, and 67). This is informed by my interview with manager Tony Tang Kai, and my observations at the Mas Camp.¹⁰² From these three case studies, I will develop a model for the process of designing a production in the Trinidad Carnival.

¹⁰⁰ Todd Gulick, Interview by Vernelle Noel, Personal interview, January 10, 2013; Dalton Narine, *Mas Man: The Complete Work*, Documentary (2011 King Carnival Productions, n.d.).

¹⁰¹ Robert Frederick, Interview by Vernelle Noel, Trinidad, December 29, 2013; James Hackett, Interview by Vernelle Noel, Skype Interview, March 4, 2013; Lari Richardson, Interview by Vernelle Noel, Personal Interview, January 8, 2013.

¹⁰² Tang Kai, Interview by Vernelle Noel, Personal interview, Trinidad, December 28, 2012.

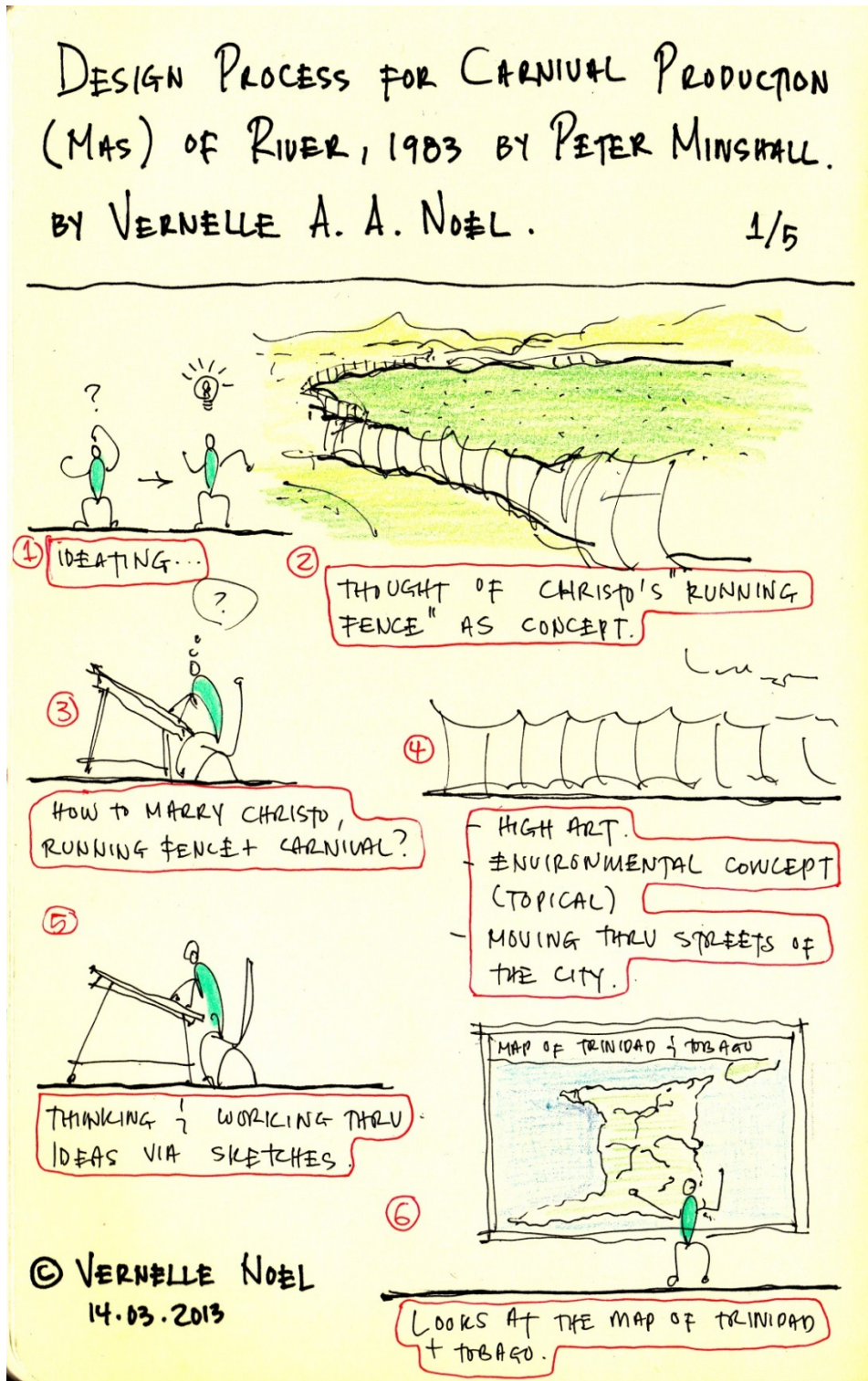
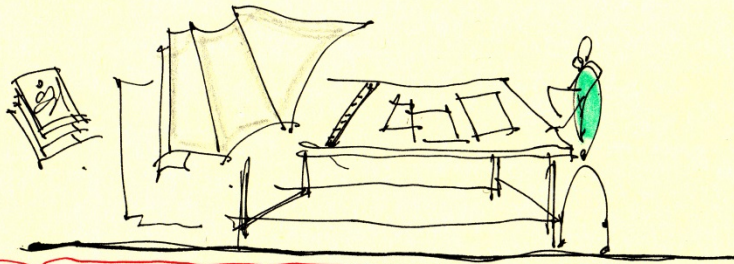


Figure 54 - "River" Design Process (Sheet 1 of 5)
© Vernelle A. A. Noel 2013

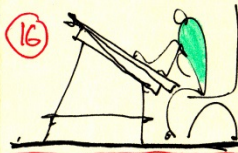


Figure 55 - "River" Design Process (Sheet 2 of 5)
© Vernelle A. A. Noel 2013



15) DESIGNS GIVEN TO FASHION DESIGNERS + PATTERN MAKERS TO CREATE PATTERNS FOR MAKING OF THE SECTIONS.

(BLANCHISSEUSE RIVER.

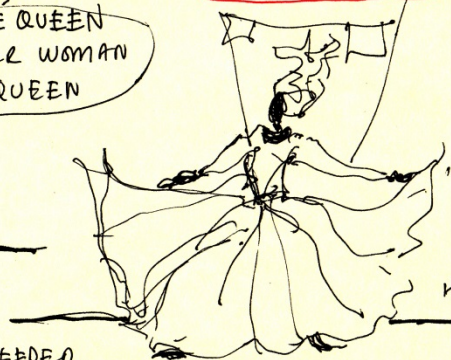


BLANCHISSEUSE IS FRENCH FOR "LAUNDRY WOMAN"

BEGINS THINKING OF THE KING + QUEEN OF THE BAND.

17) IDEAS... IN VILLAGES WOMEN WOULD WASH CLOTHES IN RIVER.

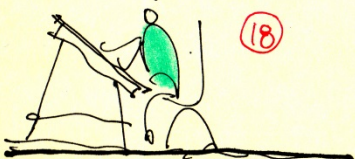
BELLE QUEEN WASHER WOMAN IS QUEEN



- GOOD
- HUMBLE
- LOVES NATURE

↑
WASHER WOMAN DESIGNED. WITH CLOTHES HANGING OUT TO DRY

DRAMATIC TENSION NEEDED.



18) TIME TO DESIGN THE KING OF THE BAND

3/5

19) QUEEN → GOOD

KING → BAD

EVIL CHARACTER

RIVER ~ ~ ~ → CRAB AS EVIL

RELATES BACK TO RIVER

CONTENT NOW INFORMS DESIGN

© VERNELLE NOEL
14.03.2013

Figure 56 - "River" Design Process (Sheet 3 of 5)

© Vernelle A. A. Noel 2013

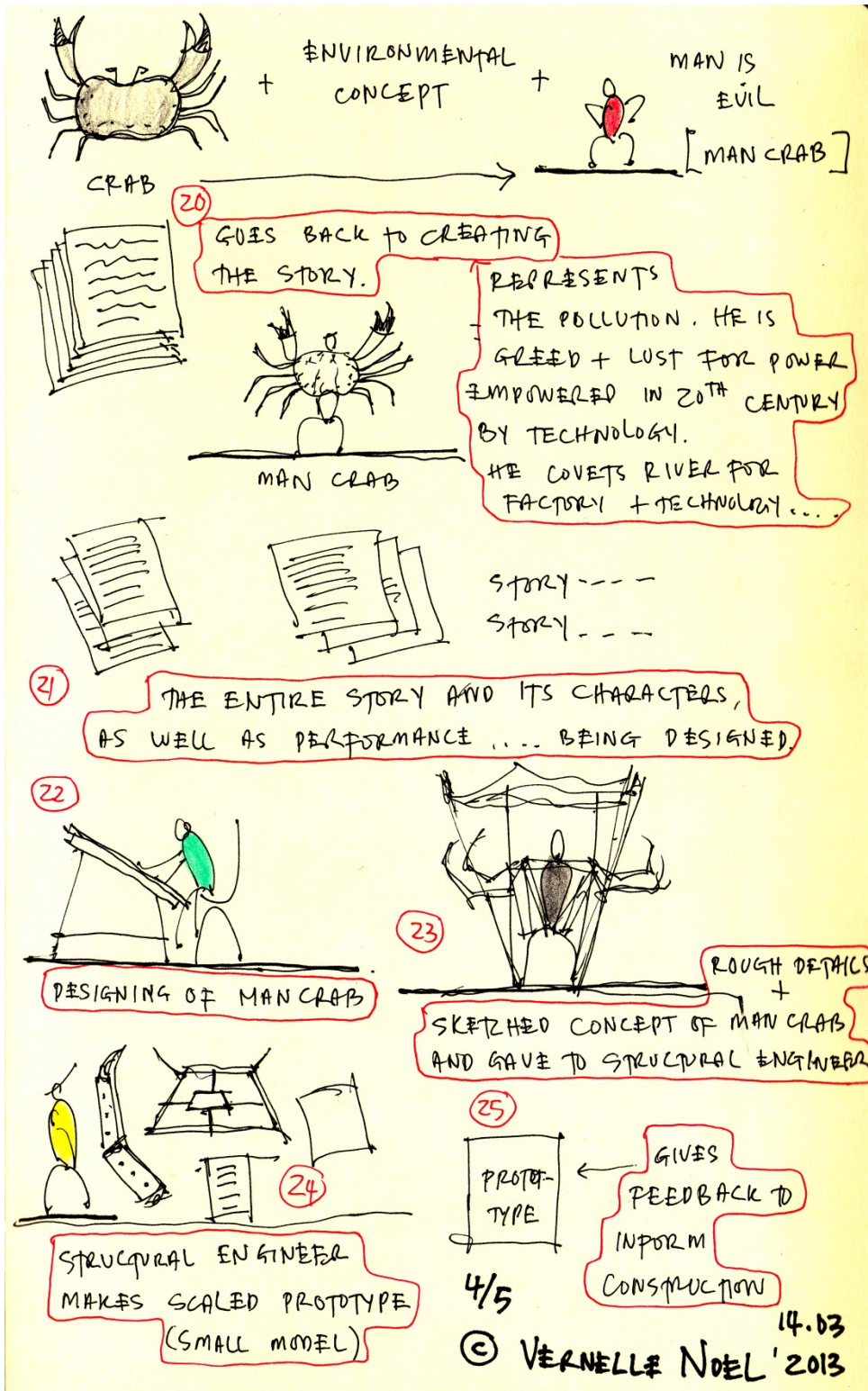


Figure 57 - "River" Design Process (Sheet 4 of 5)

© Vernelle A. A. Noel 2013

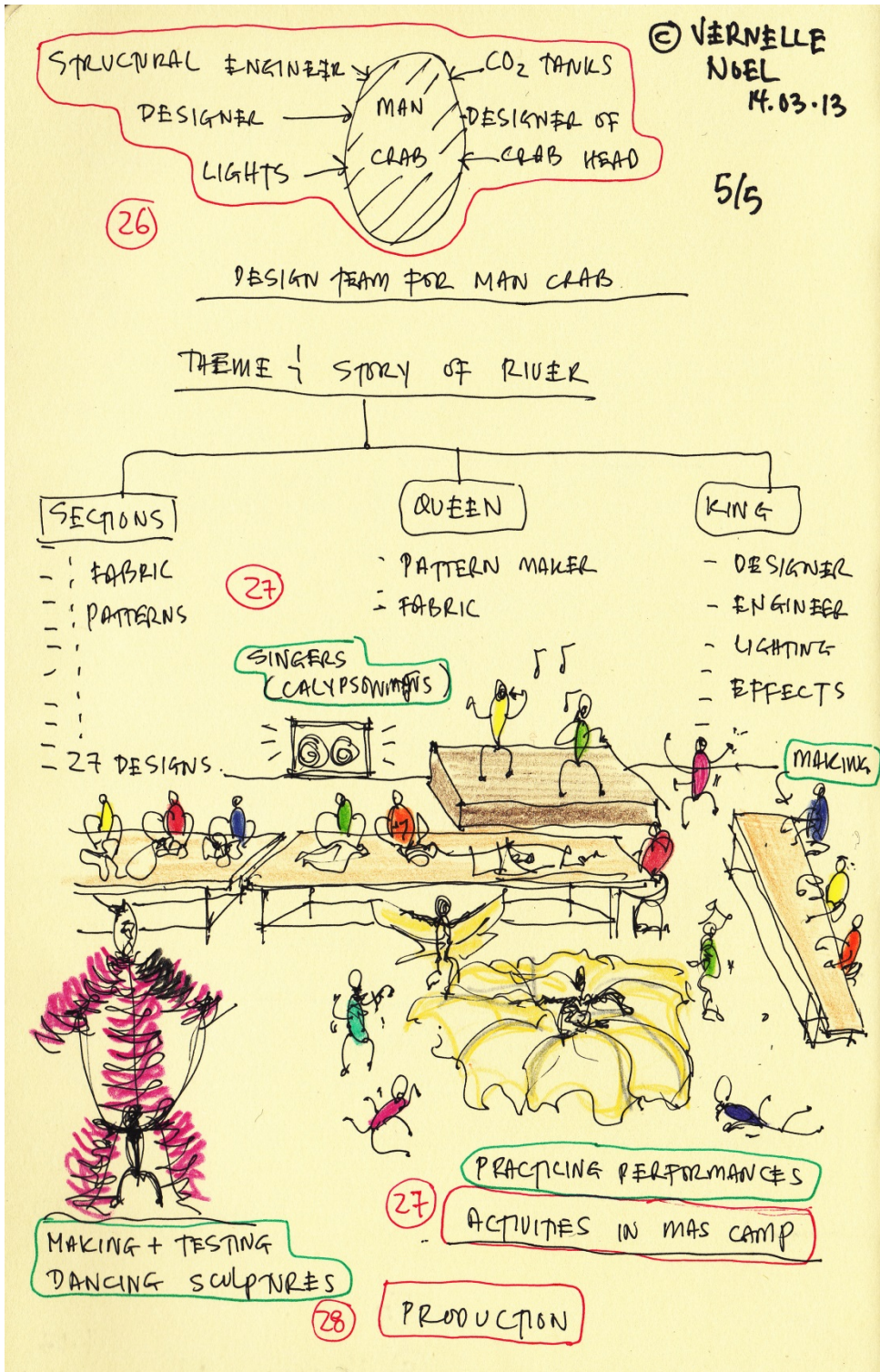


Figure 58 - "River" Design Process (Sheet 5 of 5)
© Vernelle A. A. Noel 2013

Peter Minshall, the lead designer, found inspiration for “River” from Christo & Jean-Claude’s “Running Fence” (Fig. 59).¹⁰³



Figure 59 – Running Fence
Christo & Jeanne-Claude’s ‘Running Fence’ was an inspiration to Minshall
Photo © <http://christojeanneclaude.net/>

Interpreting and translating this concept into the dynamic street festival of Trinidad Carnival was the designer’s goal. The names of local rivers were used for the band sections. He envisioned a horizontal “running fence” over a crowd of people, a river of people, masqueraders costumed in white fabric, styled in the clothes of their African, Indian, and European ancestry.¹⁰⁴ Design elements included waistcoats, bow-ties, little hats, trousers, and canes (Fig. 60).

¹⁰³ “Projects | Running Fence,” accessed April 8, 2013, <http://christojeanneclaude.net>.

¹⁰⁴ Todd Gulick, Interview by Vernelle Noel; Schechner, Riggio, and Minshall, “Peter Minshall.”



Figure 60 – Design of sections for “River” (1983)
 © Peter Minshall

The following is the creative thinking of the designer - who plays with tensions and oppositions in mas' - in developing the King and Queen of the Band. He envisioned the Queen as a good character named after a local river. The river is the Blanchisseuse River, which is French for “Laundry Woman” or “Washer Woman” as he calls her. He sees this “Washer Woman” as the Queen of the river; a good, humble, woman who loves her people and the environment. Her costuming is influenced by the Bele queen

and the designs of the band sections.¹⁰⁵ He then creates the King of the Band, her rival, an evil character. The character is part man, and part crab; named Mancrab, representing man's greed and lust for power, empowered by technology in the 20th century. The King covets the river for his factories and technology, and he will destroy the Queen, Washer Woman, to accomplish his goal. This story is played out in the designs of the dancing sculptures and the performances on the competition stage.

¹⁰⁵ Bele – a Caribbean folk dance with African and French influence performed by women

II Case Study 2 - SoBelt's "Aqua 70/30" (2013)

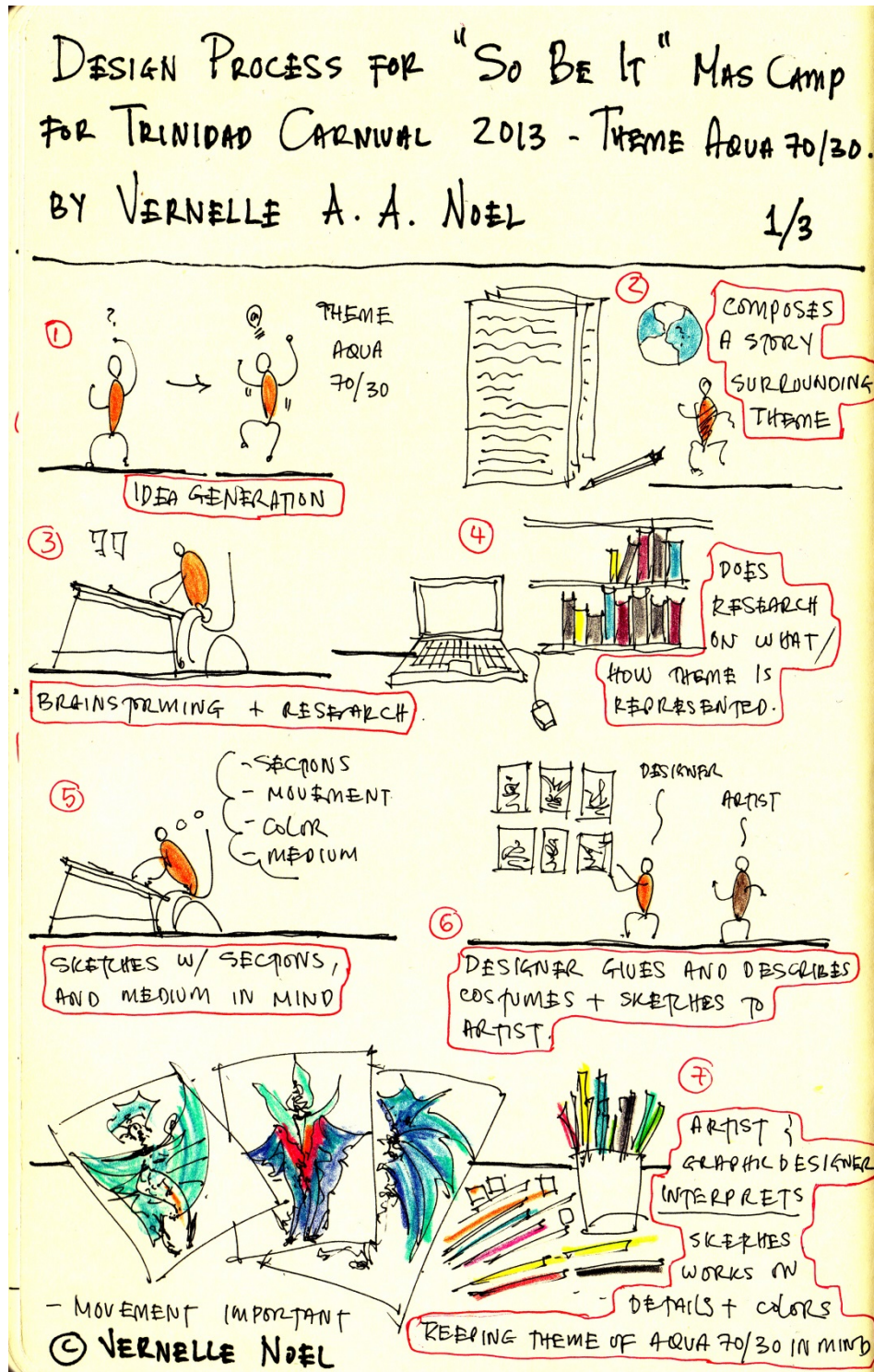


Figure 61 - "Aqua 70/30" Design Process (Sheet 1 of 3)

© Vernelle A. A. Noel 2013

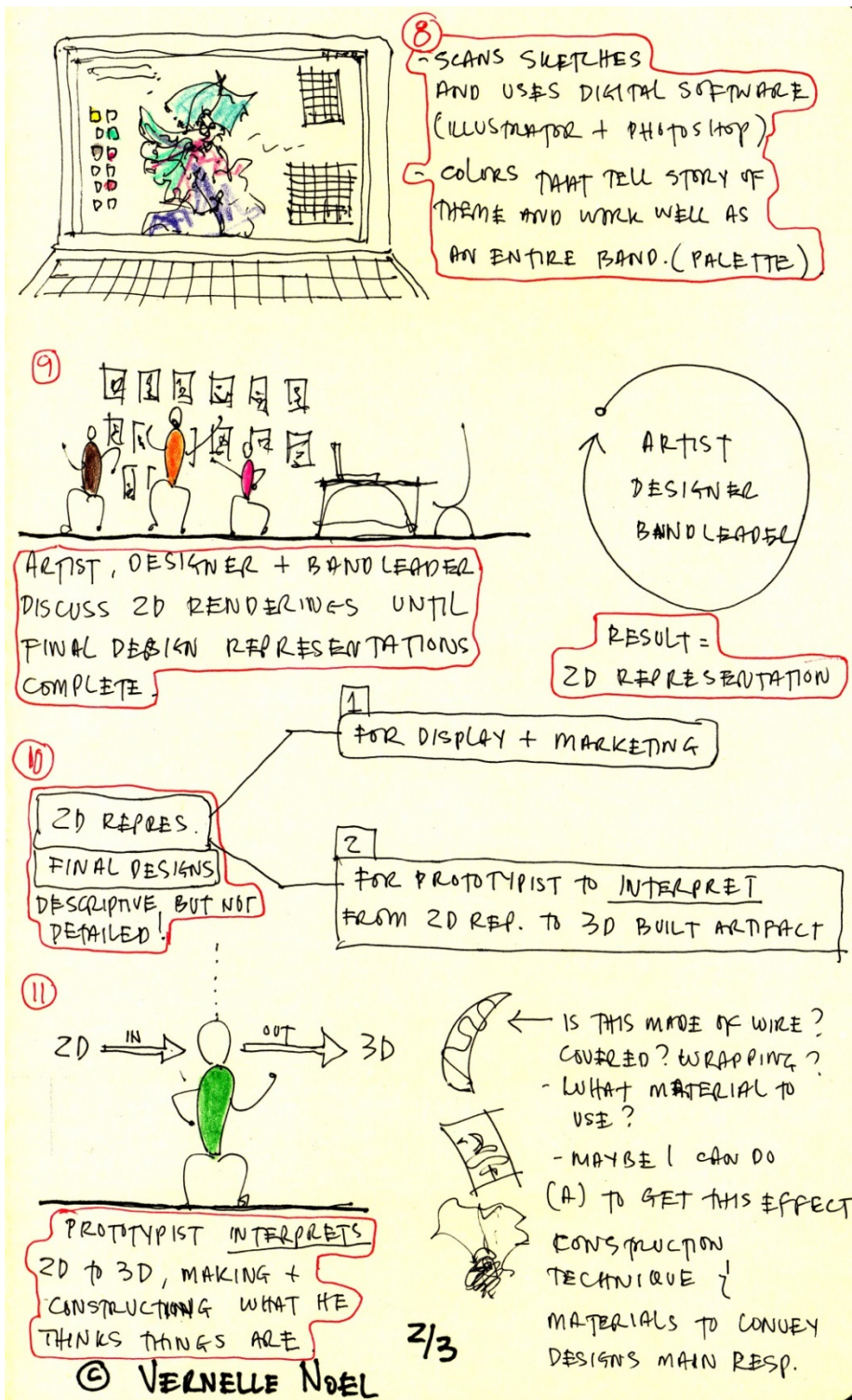


Figure 62 - "Aqua 70/30" Design Process (Sheet 2 of 3)
 © Vernelle A. A. Noel 2013

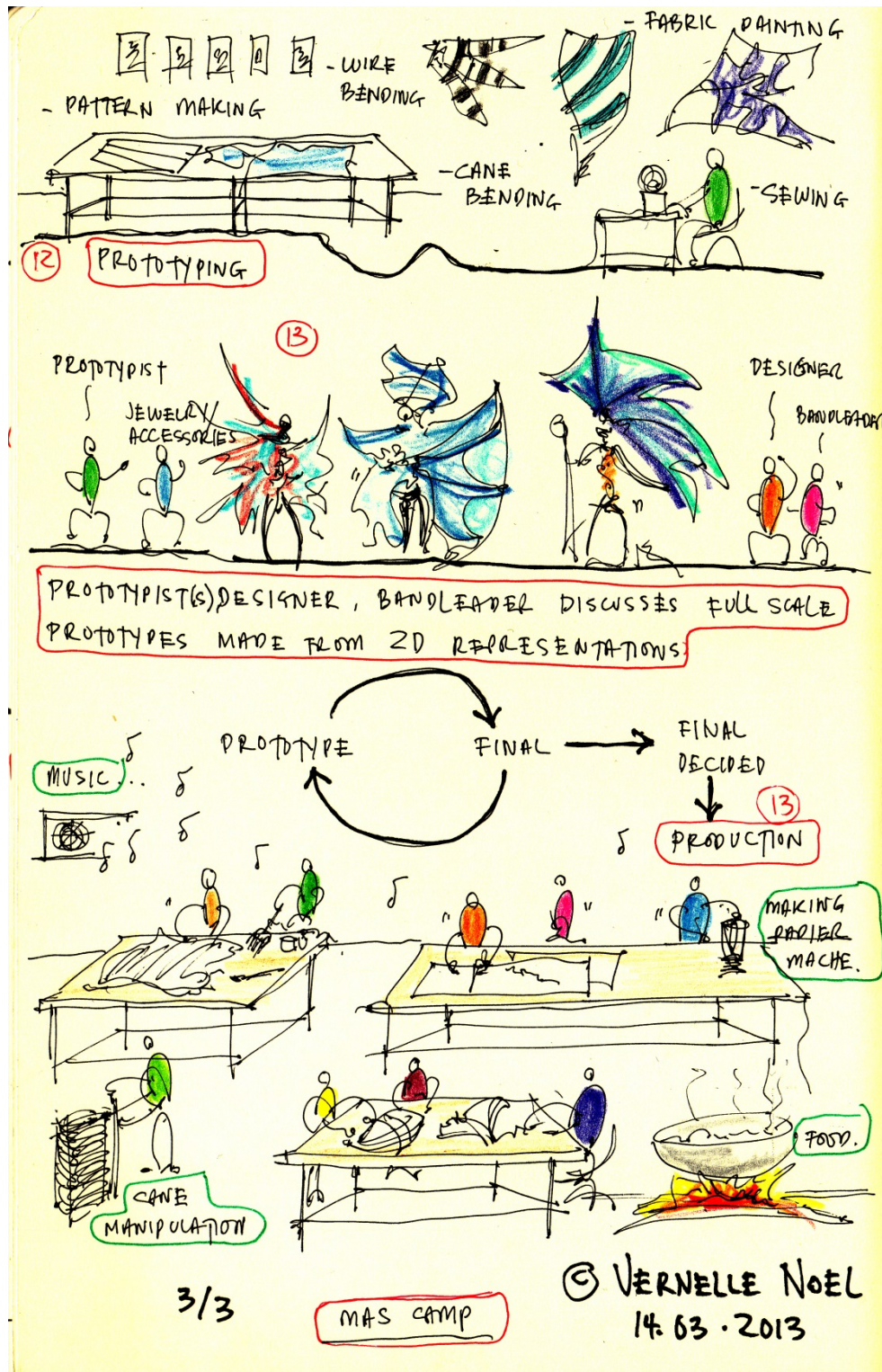


Figure 63 - "Aqua 70/30" Design Process (Sheet 3 of 3)
 © Vernelle A. A. Noel 2013

The designer and the bandleader for SoBelt, came up with Aqua 70/30 for the theme and story of their band. The artist worked from sketches by the designer to develop 2D artwork (Fig. 64, and 65) which was used for display, marketing, and prototyping.



Figure 64 – Costume artwork
Artwork for Aqua 70/30 - Manta
© James Hackett 2013



Figure 65 – Costume artwork
Artwork for Aqua 70/30
© James Hackett 2013

Renderings were deliberately described with little detail with the resulting 2D representations describing the color palette and the design intent. The design interpreter cum prototypist then interpreted these renders into 3D artifacts. Notice the difference between the two approaches. SoBelt came up with a theme, developed a story to support that theme and created conceptual designs from them. Minshall, on the other hand, began with the idea of an art project, developed a story, design concept, and language based on the people, the geography, their history, and current issues. No

one approach is better than the other; they are merely different approaches to the design and idea generation process at two different periods – 2013 versus 1983.

III Case Study - Brian Mac Farlane "Joy - The Finale" (2013)

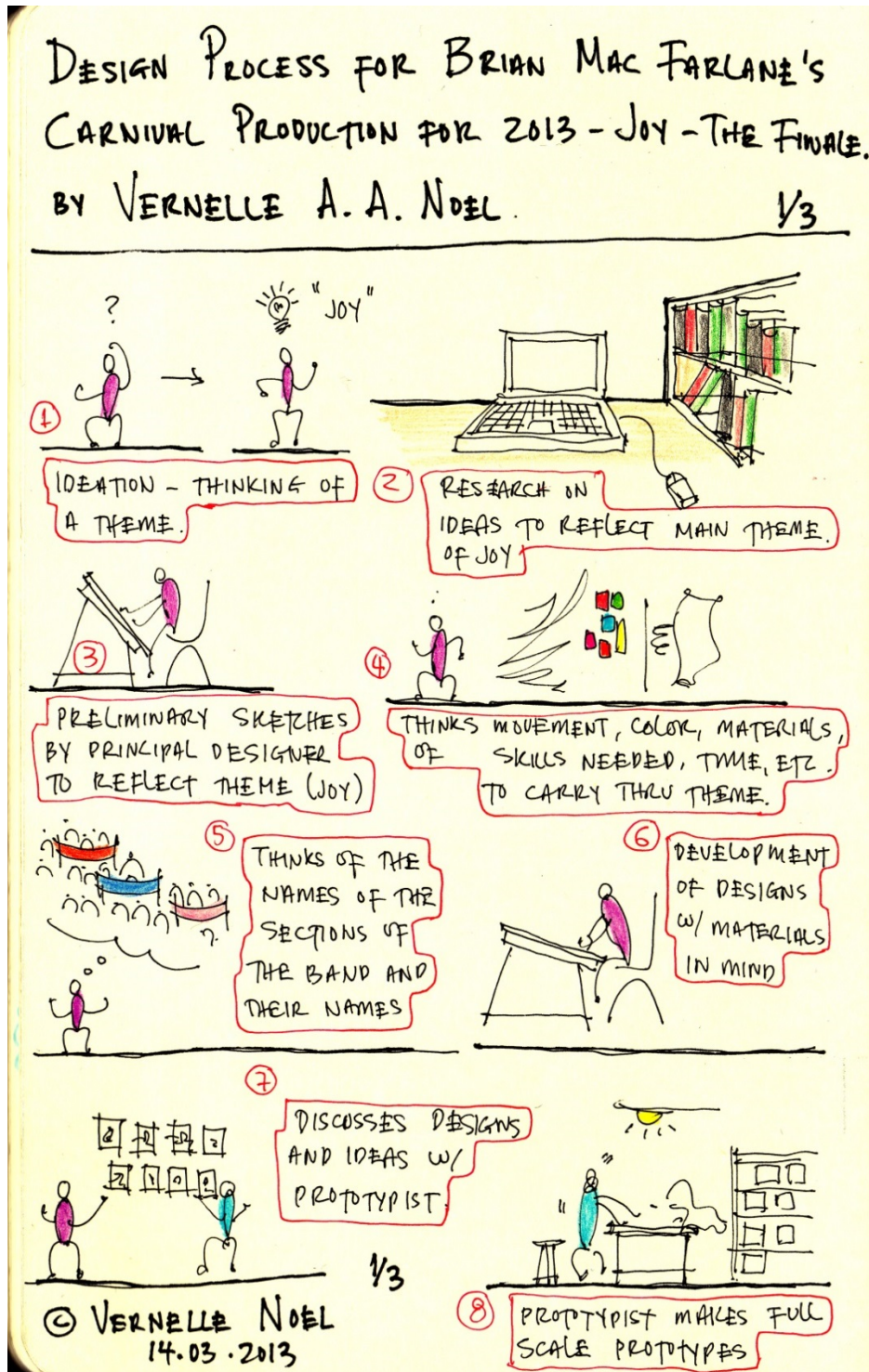


Figure 66 - "Joy - The Finale" Design Process (Sheet 1 of 2)

© Vernelle A. A. Noel 2013

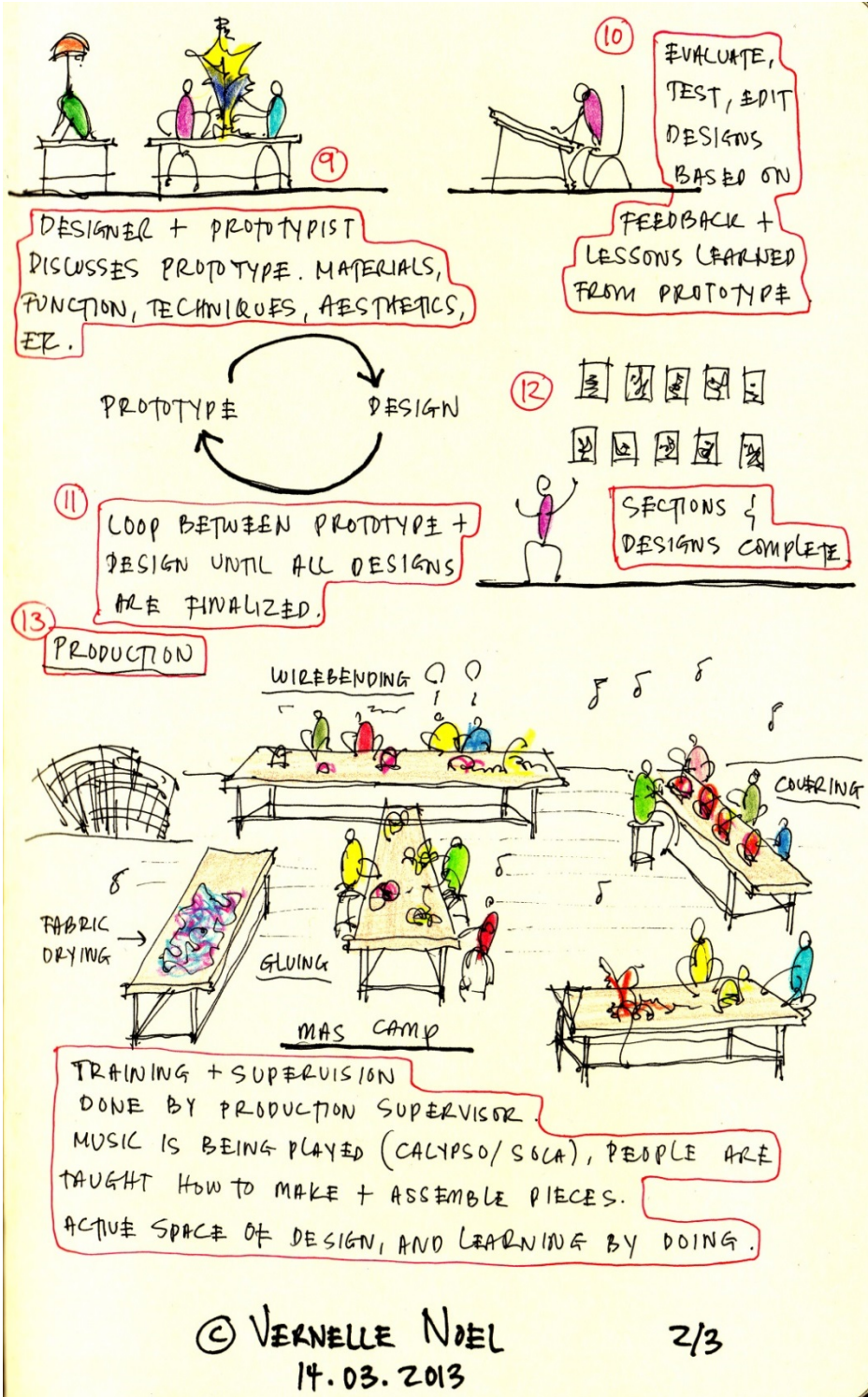


Figure 67 - "Joy - The Finale" Design Process (Sheet 2 of 2)
 © Vernelle A. A. Noel 2013

The bandleader and designer, Brian Mac Farlane brainstormed on the theme of the band, which was, "Joy – The Finale." Mac Farlane then produced sketches reflecting the theme, and thought of the medium to achieve his design intent. These ideas were discussed with the prototypist who built the costumes. After designs and techniques were agreed on, display and production of the designs began.



Figure 68 – Activity at Mas Camp
Persons involved in the costume-making
process at the Mas Camp
Photo © Vernelle A. A. Noel 2013



Figure 69 – Activity at Mas Camp
Painted fabric left to dry at the Mas Camp
Photo © Vernelle A. A. Noel 2013

3.1.3.6 Abstraction of the current design processes in Carnival

An abstraction of the design process is created (Fig. 70, 71, 72, and 73) and is informed by interviews with those involved in design in the Trinidad Carnival in Trinidad, the UK, and other Caribbean islands.¹⁰⁶

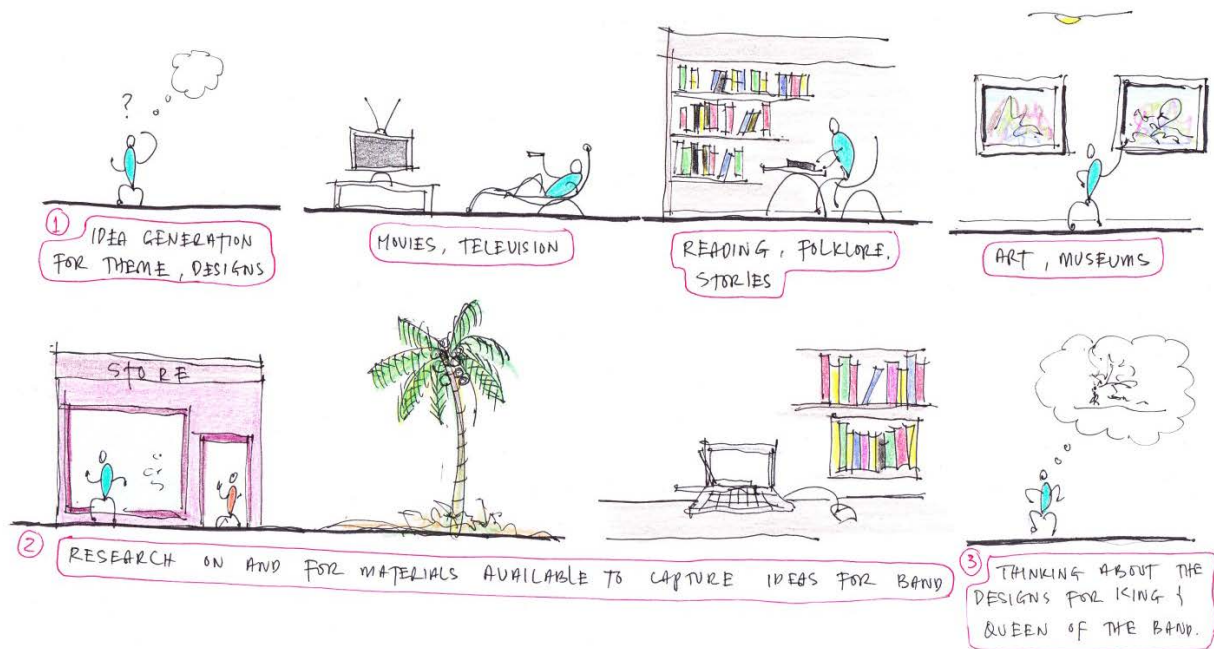


Figure 70 – Design Process
Sketches © Vernelle A. A. Noel 2013

Current steps in the design process involve:

- a) Idea generation – coming up with ideas for the theme of the band, the King and Queen of the Band which may come from almost anywhere.

¹⁰⁶ Robert Frederick, Interview by Vernelle Noel; Robert Miller, Interview by Vernelle Noel; Stephen Derek, Interview by Vernelle Noel; Todd Gulick, Interview by Vernelle Noel; Tony Tang Kai, Interview by Vernelle Noel; Peter Minshall, Interview by Vernelle Noel; Clary Salandy, Interview by Vernelle Noel, Skype, March 9, 2013.

b) Search for materials to make ideas become a reality.

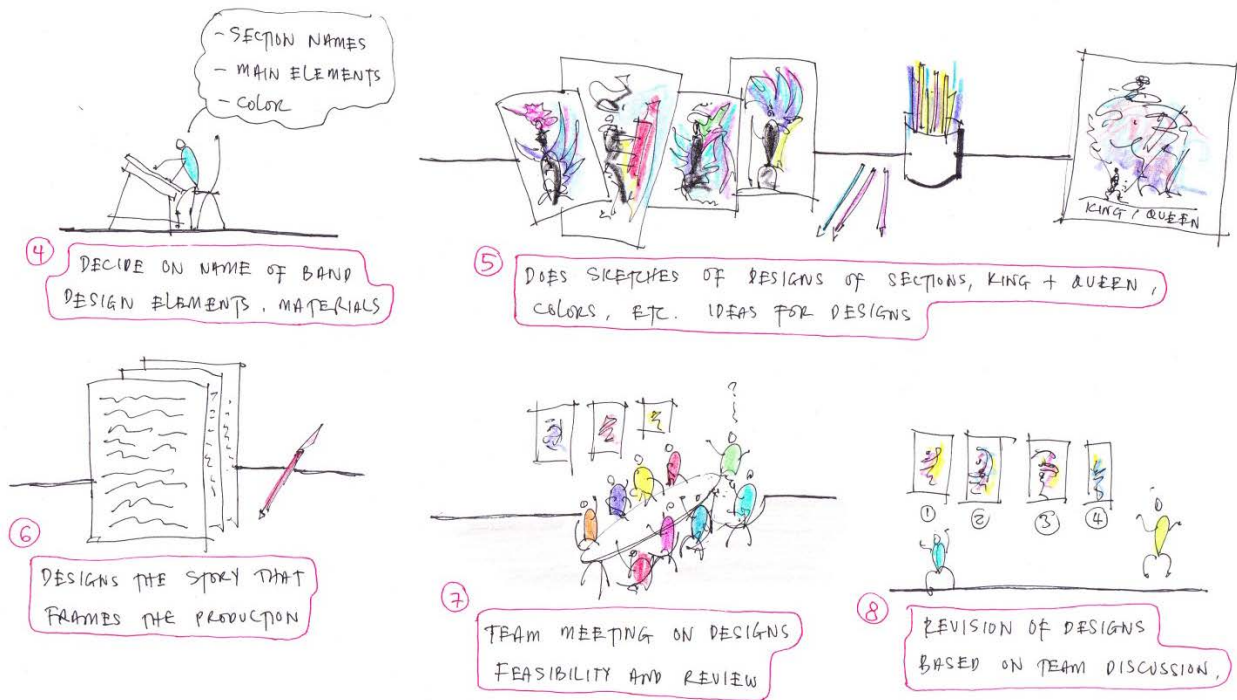


Figure 71 – Design Process
Sketches © Vernelle A. A. Noel 2013

- c) Deciding on the name of the band, the names of the sections, the design elements of each section, and the story tying it all together.
- d) Producing sketches of the designs.
- e) Design review with the designer, band leader, and sometimes the artist.
- f) Design revisions.

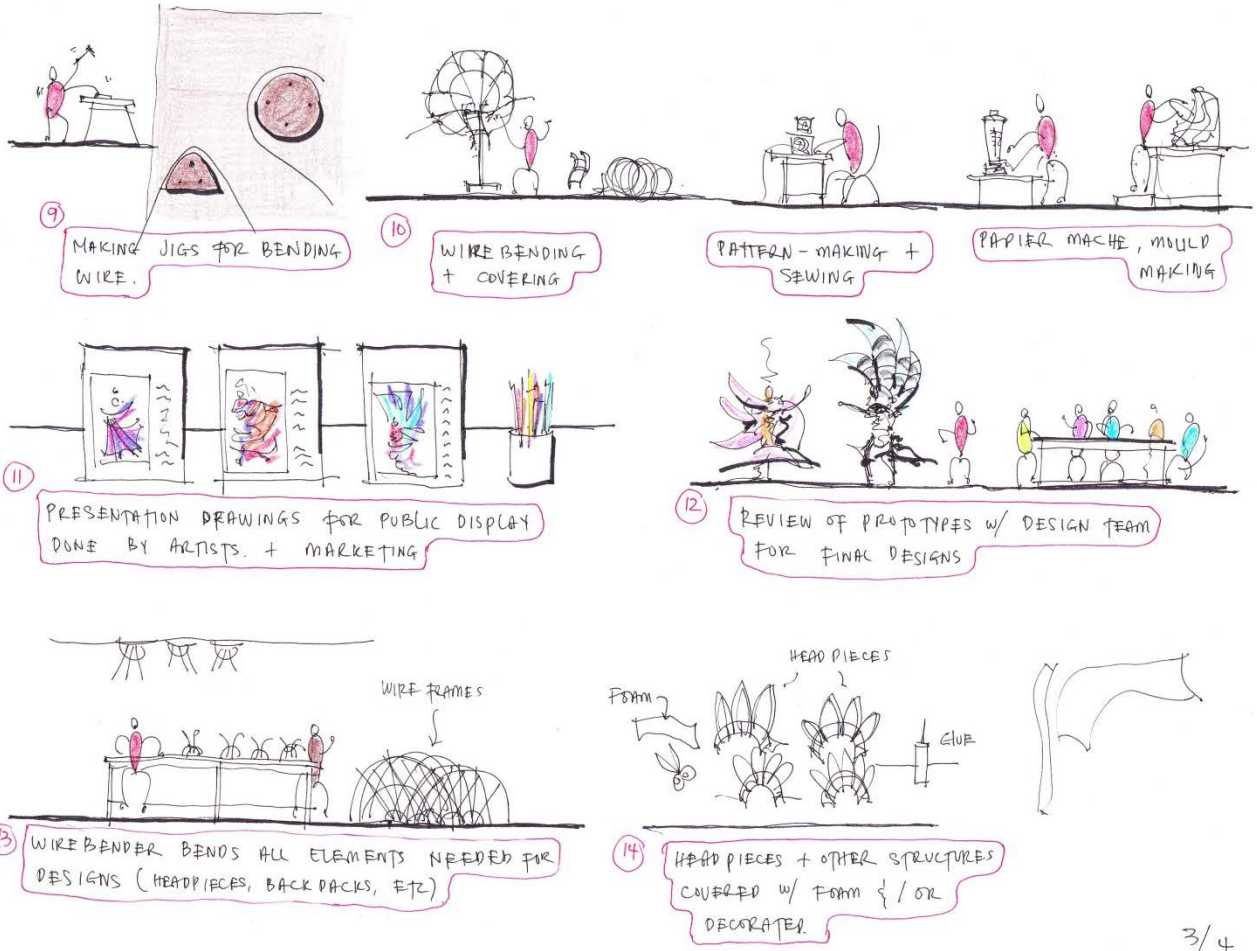


Figure 72 – Design Process
 Sketches © Vernelle A. A. Noel 2013

- g) Prototyping occurs simultaneously with the display of designs to the general public.
- h) Prototype review for feedback on construction technique, materials, design, and assembly.
- i) Production of costumes begin, the amount depending on the number of masqueraders signing up to play with the band.

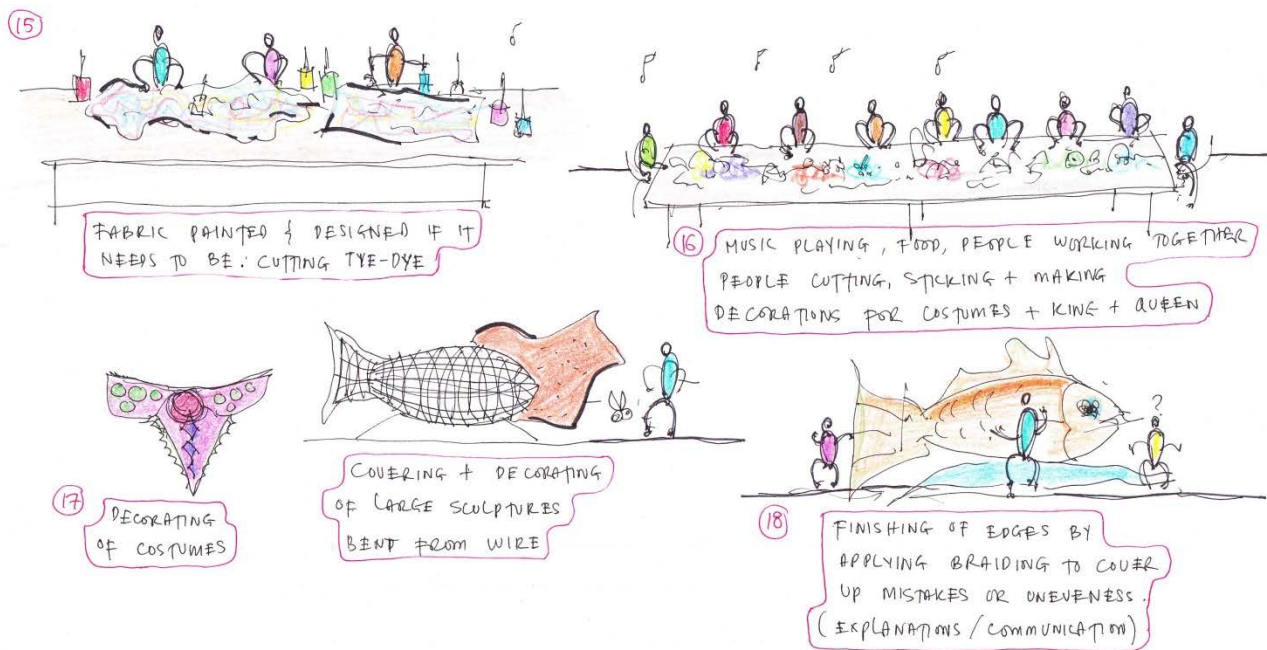


Figure 73 – Design Process
 Sketches © Vernelle A. A. Noel 2013

j) While the production team works on the costumes, a smaller team works on constructing the King and Queen of the Band.

The design process for costumes, dancing sculptures and other artifacts in the Trinidad carnival can be broken down into three main stages: (1) the Conceptual Design Stage which will include: ideation, research, and concept design (2) the Design Development Stage which will include more detailed sketches and prototyping, and (3) the Production Stage. The conceptual design stage involves brainstorming, ideating, doing research on ideas or techniques, and in some cases, coming up with the story that informs the entire band, tying all the elements together almost seamlessly, and taking the

movement desired into consideration in this dynamic art. The design development stage is informed by the results of the conceptual development stage. Sketches, ideas for materials, techniques, and the story is further developed and refined. The making of prototypes at this stage will further inform and advance the design of the artifacts and the parade (performance). Technical integrity, movement, and performance is evaluated from the prototypes. The results of the development design stage are full detailed descriptions of the designs (materials, construction, and dimensions) and final prototypes. The production stage is the final stage and will involve building and constructing the costumes, and dancing sculptures, and if any, designing the performance required to tell the story. In this section on tools and mediating artifacts I discuss the use of tools, drawings, prototypes, and processes in the shaping of the object(ive)s in the Trinidad Carnival.

3.1.4 Rules

Rules in an activity system are guidelines, conventions and social interactions acceptable by the community to accomplish the object(ive)s. They guide activities so that the tools individuals and groups use, reconcile the design process, reducing conflict that may arise due to different interpretations.¹⁰⁷

3.1.4.1 Interactions

The context in which design happens in Trinidad carnival is at the heart of the “carnival spirit.” Design, production, and distribution takes place at Mas Camps. Some run all year round from the same location, designing, and constructing artifacts for carnivals around the world.

Mas Camps are central to design activities in carnival. The following describes the atmosphere and the non-design activities that take place during the carnival season at Mas Camps (Fig. 74, and 75). They include:

1. Calypso/ soca music playing – Soca music is playing most times at the Mas Camps while persons work. One bandleader even called into a popular radio station to send greetings to those working at his Mas Camp.¹⁰⁸ People at the Mas Camp would occasionally break out in impromptu singing and dancing.

¹⁰⁷ David H. Jonassen and Rohrer-Murphy, “Activity Theory as a Framework for Designing Constructivist Learning Environments,” March 1, 1999.

¹⁰⁸ Music native to Trinidad. Soca music is usually party music, with fast beats.

2. Friends and family working together – Persons collaborating in the process were family, friends, and neighbors from the community. New additions to Mas Camps quickly become friends after working together during the season.¹⁰⁹
3. Different generations working together – There were adults and kids, grandparents, and parents working together.
4. Cooking/ food – Eating or cooking at Mas Camps for all to eat is a frequent event, and occurred at two of the Mas Camps I visited. Bandleader, Stephen Derek was “bubblin’ a pot” (cooking) for all to eat.¹¹⁰ At SoBelt, Frederick baked bread and we all partook, chatting as we ate.
5. Friendly environment.
6. A sense of happiness from doing something creative.
7. Excitement by individuals for upcoming carnival competitions and parties.
8. Visitors stopping by to see friends, the activities, and the development of the costumes.

¹⁰⁹ Derek, Interview by Vernelle Noel.

¹¹⁰ “Bubbling a pot” means cooking, most times for a festive occasion or event.



Group dynamics and collaboration



Discussion & communication of ideas



Family discussion of ideas



Collaboration and learning



Learning while doing



Family and friends working together



Kids involved in making



Kids working together



Kids learning



Adults and kids working together



Customers trying on costumes



Working and talking together all to the sounds of calypso music



Making together



Different generations working together



Figure 74 - Activities at Mas Camps
Activities at Mas Camps during Trinidad Carnival season
© Vernelle A. A. Noel 2013



Mother working with baby



Adult family and friends playing with kids



Working together



Meeting



Discussing design decisions



Making



Patterning and sewing



Sister teaching brother



Friend stops by Mas camp with baby



Group dynamics



Learning & creativity



Learning & creativity



Communication and collaboration



Mom working with baby on her lap



Creativity and making

Figure 75 - Activities at Mas Camps
Activities at Mas Camps during Trinidad Carnival season
© Vernelle A. A. Noel 2013

In my research, I sought to investigate the importance of Mas Camps. Design interpreter and prototypist Robert Frederick told me, “There is a family bonding, friends, and friendships. At the Calaloo Company (Peter Minshall’s Mas Camp), it was amazing. It is very important. Cook a meal and people participate in the meal, chat, and it’s a beautiful experience to see all the different artists moving and see[ing] it come together. [When it is assembled offsite], it feels commercial and there is no relationship and love. There is a love in carnival. [It’s] not for everyone, but for those who feel it, they sense and feel that magic. There must be [a] Mas Camp feel.”¹¹¹

Fashion designer Meiling who worked with Minshall reminisced, “He (Minshall) read the most obscure pieces of literature. [...] There would be people taxi-ing down on a Sunday morning at 10 o clock. Calypsonians, dancers, and artists would perform at the Mas Camp and all would listen and learn from these artists.”¹¹² Designer, Liselle Astread Frauenfelder commented, “The vibe, the people, and the interaction with each other. You can learn something from someone. It seems to be a great place to learn how to socialize and be respectable of each other, the arts, and artists. It is one big family, which is also transferred to the work. Interaction is important, and the person to person interaction is the spirit of mas. No interaction with music, and food, no mas.”¹¹³

¹¹¹ Frederick, Interview by Vernelle Noel. Trinidad, WI, December 29, 2012.

¹¹² Meiling Esau, Interview by Vernelle Noel, Trinidad, WI January 4, 2013.

¹¹³ Frauenfelder, Interview by Vernelle Noel; Vibe – a word that carries the meaning of a feeling, a spirit.

Designer, bandleader, and wire bender Stephen Derek reflected on the feeling of togetherness he had in Mas Camps as a youth. ¹¹⁴ "If you had a problem, someone could come and help you solve that problem. Everyone [would be] talking to each other and [be] comfortable. That feeling of being wanted and secure, when you leave, you want to come back," he told me. Derek worries that this environment may be in jeopardy. "Mas Camps are not what they used to be. It was a community thing where people eat, laugh, music [playing], cook[ing food], drinking and everyone [is] happy. These conglomerates [are] destroying that spirit of the Mas Camp. The money is going out of the country because they [are] purchasing costumes from outside [overseas in China, etc.] and selling it to the people. [They are operating] like Neal & Massy, they buy, and assemble. They distribute." ¹¹⁵

Masquerader, Adele Rose, in recounting her experience as a youth said, "In my teens I actually used to go to the various Mas Camps and volunteer in the costume assembly lines. Whether it was gluing materials on to costumes, cutting out waistband forms, measuring and cutting lengths of beads, counting out feathers, it was all quite thrilling and gave me a sense of ownership as I couldn't wait to see the costumes I had helped to put together on the road." ¹¹⁶ Another masquerader, Lesley-Ann Jones said, "I [saw] large pieces created when I was much younger. It is a grand sight, very breathtaking to

¹¹⁴ Derek, Interview by Vernelle Noel.

¹¹⁵ Neal & Massy – automotive company

¹¹⁶ Adele Rose, Interview by Vernelle Noel, Emailed interview, November 7, 2012.

observe.”¹¹⁷ Many persons I interviewed however, never witnessed a costume being produced. I believe this is a missed opportunity.¹¹⁸ Some aspects of Mas Camps that were important to persons I interviewed included: the feeling of community, bonding with family and friends, working together, cooking and eating together, learning social skills, learning the arts, the feeling of security, the sense of ownership, investment, and amazement. My thesis seeks to retain and heighten these positive experiences at Mas Camps.

3.1.5 Community

The community in this activity system of the Trinidad Carnival includes those who work on, or share in the object(ive), and whose influences bear on the object(ive).¹¹⁹ In the context of Trinidad Carnival, this includes all subjects previously mentioned (bandleaders, designers, artists, etc.), Mas Camps, government ministries, state appointed commissions, masqueraders, the business community, media houses, sponsors, and tourism boards, to name a few. Examples of members of this community include the:

- National Carnival Bandleaders Association of Trinidad & Tobago (NCBA)

¹¹⁷ Lesley-Ann Jones, Interview by Vernelle Noel, Emailed interview, October 30, 2012.

¹¹⁸ Kristal Peters, Interview by Vernelle Noel, Emailed interview, October 30, 2012; Virginie Aline, Interview by Vernelle Noel, Emailed interview, October 30, 2012.

¹¹⁹ Jonassen and Rohrer-Murphy, “Activity Theory as a Framework for Designing Constructivist Learning Environments,” March 1, 1999; Joanne Hardman, “Activity Theory as a Potential Framework for Technology Research in an Unequal Terrain,” *South African Journal of Higher Education* 19, no. 2 (2005): 378–391; Joanne Hardman, “An Activity Theory Approach to Surfacing the Pedagogical Object in a Primary School Mathematics Classroom,” *Outlines. Critical Practice Studies* 9, no. 1 (2007): 53–69.

- National Carnival Commission (NCC), and the
- Tourism Development Company Limited (TDC)

These groups influence activities in Trinidad Carnival. The objective in my Carnival activity system is to produce artifacts that showcase citizens' creativity. Based on my analysis, more communities focusing on design activities can be formed. Examples would include organizations and associations for designers, wire benders, prototypists, and masqueraders. Creating these organizations around a shared meaning of these activities in carnival will result in improvement. Members can work together to develop their skills; educate its members and citizens, all with their collective beliefs at the fore.

3.1.6 Division of Labor

Division of labor in an activity system describes the horizontal division among members in the same community or same expertise, and vertical divisions of labor between those at different levels. It also prescribes the tasks that members of the community are involved in, and their interactions.

3.2 Reference & Impact Models

In this thesis I developed models to understand and explain the reality of design in the Trinidad Carnival. These models show significant relationships between factors affecting the problem, presents my theory on the reason for the current aesthetic in carnival, and highlights the areas I focus on, to address this issue.

3.2.1 Reference Model (Existing Situation)

The Reference Model in Figure 78 represents my understanding of the existing situation in design in Trinidad Carnival, identifies the factors to be addressed, and clarifies my line of argument. The model comprises factors that influence the existing situation, and are based on my field research, review of literature, investigations, and statements from those involved in design activities in Carnival. Key factors are influencing factors I will address in my thesis in order to improve the existing situation.

There is a concern that the art of wire bending in Trinidad may be dying, and I investigated this in my field work. I asked expert wire bender, Albert Bailey, if wire bending was dying.¹²⁰ He replied, "Wire benders are dying. Nowadays men don't do much structure work, they do beadwork, not much form. Forms are missing from carnival, it has gone commercial. Wire [bending] gives the form." Stephen Derek, another expert wire bender, echoed these sentiments when he stated, "There are not

¹²⁰ Albert Bailey, Interview by Vernelle Noel, January 4, 2013.

enough competent wire benders in Trinidad & Tobago to produce the mas."¹²¹ Anthony Tang Kai stated," Wire bending is a dying art. Costumes are now more minimalist, using feathers and beads as embellishments rather than structures (wire)."¹²² Bandleader Roland St. George said, "The skilled people are few and far between..."¹²³ Added to this lack of competent wire benders, there is currently no documentation of this craft. There are no schools or systems in place for transferring this knowledge of wire bending to others.

In an attempt to get a feel for, and understand the process of wire bending, I bent a three dimensional form (Fig. 76 and 77).

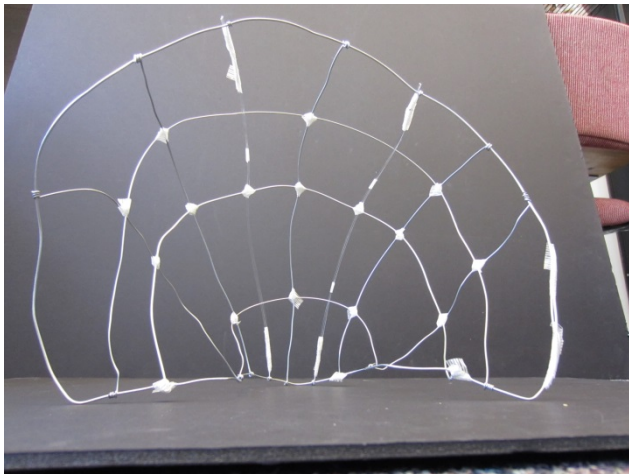


Figure 76 – Wire bent form
Form bent from wire by Vernelle A. A. Noel



Figure 77 – Wire bent form
Form bent from wire by Vernelle A. A. Noel

¹²¹ Derek, Interview by Vernelle Noel.

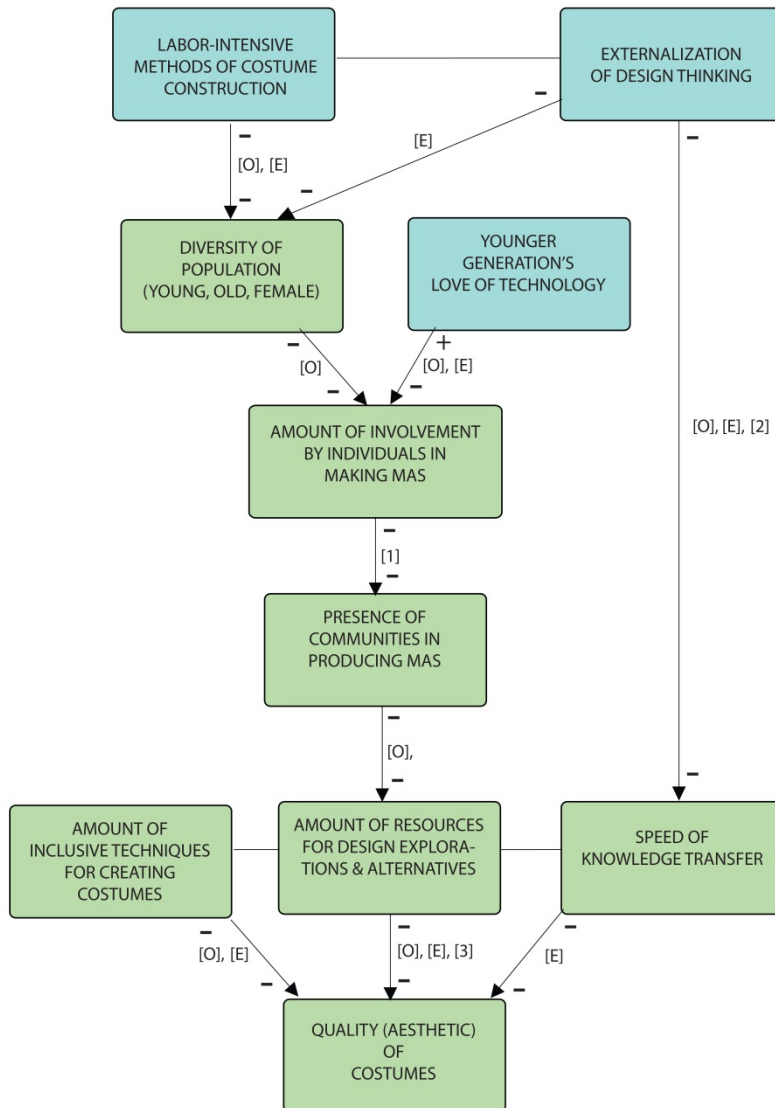
¹²² Tang Kai, Interview by Vernelle Noel.

¹²³ St. George, Interview by Vernelle Noel.

This form is approximately 14 x 11 x 10 inches in dimensions, and took me 3 hours to complete. This construction technique of wire bending is extremely labor intensive. I discovered that this method of form-making in costume construction does not easily include participation by children, women, the aged, and the infirmed. This added to my understanding, and also gave me the opportunity to test my wire bending grammar. The key factors that I address here are: (1) the labor intensive means of costume construction, (2) the lack of externalization of design thinking, and (3) the younger generation's love of technology.

REFERENCE MODEL

Existing situation in Design in Carnival



LEGEND

- XYZ Key factor in existing situation
- XYZ Influencing factor in existing situation
- ABC Other known related factor outside current scope of research
- Link
- +, - Value of attribute
- [1] Published statement
- [A] Statement based on assumption
- [E] Statement based on experience of stakeholders
- [O] Statement based on my own investigations
- [?] Unknown if link exists

Vernelle A. A. Noel

- [1] Garth L. Green and Philip W. Scher, *Trinidad Carnival: The Cultural Politics of a Transnational Festival* (Indiana: Indiana University Press, 2007).
- [2] H. Meerkamm, "Methodology and Computer-Aided Tools - A Powerful Interaction for Product Development," in *The Future of Design Methodology*, ed. Herbert Birkhofer
- [3] Lucienne Blessing. "Comparison of Design Models Proposed in Prescriptive Literature." *Social Shaping of Design: The Role of Design in the Shaping of Technology*.

Figure 78 – Reference Model
Reference Model representing the existing situation

The existing situation in design in the Trinidad Carnival (Fig. 78) is that labor intensive methods of costume construction exclude a substantial group of people. When coupled with little externalization of design thinking and methods in carnival, the result is a reduced section of the population participating in design activities. Due to the younger generation's love of technology, and the lack of diversity of participants, a small number of individuals get involved in making mas. This lack of individual involvement in making mas, results in a lackluster presence by communities in making mas. The lack of community presence then results in a lack of resources (time and people) to carry out design explorations and create design alternatives. When this lack of resources is coupled with current limited techniques in costume construction and the slow speed of knowledge transfer - due to the lack of externalization of design thinking - the result is the current bikini and beads aesthetic in the Trinidad Carnival.

Current problems in design in the Trinidad Carnival include the:

1. Lack of skilled wire benders.
2. Lack of time and resources to generate design alternatives.
3. Lack of an inclusive and diverse design process.
4. Lack of interest by the younger generation.

The consequences of these problems include the:

1. Potential death of the traditional art form of wire bending – wire bending is important for creating forms in costumes and other carnival artifacts. Loss of this art form affects the character of costuming, and the potential for development of this art form.
2. Changing aesthetic in Trinidad Carnival (Fig. 5) – this aesthetic is neither culturally sustainable (employing local materials), nor grounded in local culture (local skills and practices).
3. Little design alternatives generated – the ability to generate and evaluate design alternatives has a positive impact on the outcome.
4. Lack of involvement by individuals & communities – involvement by communities would lead to stronger community ties, safe social interactions between individuals in the community, creative outlets, and increased resources (human and time) for design explorations and alternatives.
5. Poor quality of finish and structural integrity of costumes - improper construction techniques can lead to costume failures in competitions, and parades.

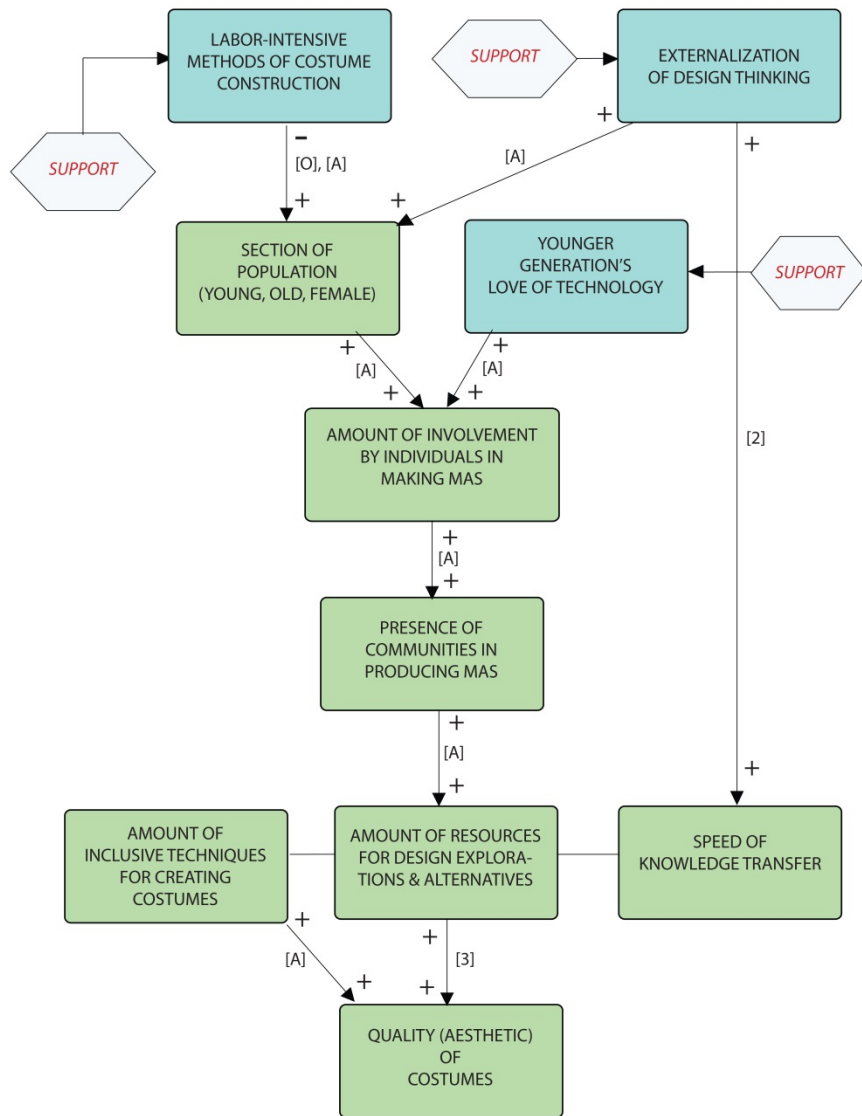
In this thesis, I seek to address these problems by employing computational tools, and digital technology to capture wire bending, generate design alternatives, create a more inclusive design process, and build on the younger generation's love of technology.

3.2.2 Impact Model (Desired Situation)

The Impact Model in Fig. 79 represents the desired situation. Here I introduce design support and illustrate the desired impact this support will have on design in the Trinidad carnival.

IMPACT MODEL

Desired situation in Design in Carnival



LEGEND

- XYZ Key factor in existing situation
- XYZ Influencing factor in existing situation
- XYZ Support
- ABC Other known related factor outside current scope of research
- Link
- +, - Value of attribute
- [1] Published statement
- [A] Statement based on assumption
- [E] Statement based on experience of stakeholders
- [O] Statement based on my own investigations
- [?] Unknown if link exists

Vernelle A. A. Noel

- [1] Garth L. Green and Philip W. Scher, *Trinidad Carnival: The Cultural Politics of a Transnational Festival* (Indiana: Indiana University Press, 2007).
- [2] H. Meerkamm, "Methodology and Computer-Aided Tools - A Powerful Interaction for Product Development," in *The Future of Design Methodology*, ed. Herbert Birkhofer
- [3] Lucienne Blessing. "Comparison of Design Models Proposed in Prescriptive Literature." *Social Shaping of Design: The Role of Design in the Shaping of Technology*.

Figure 79 – Impact Model
Impact Model representing the desired situation

The desired situation

In Lucienne Blessing's paper entitled, *A comparison of design models proposed in prescriptive literature* (1996), Blessing found that the ability to generate design alternatives and evaluate them in the design process had a positive impact on the outcome.¹²⁴ This observation supports my proposal to deploy computational tools to generate new designs and alternatives. In Herbert Birkhofer's book titled, *The Future of Design Methodology* (2011), Meerkamm in the chapter entitled, *Methodology and Computer-Aided Tools – a Powerful Interaction for Product Development* describes the opportunities that can be had from the interaction between design methods and computer-aided tools if [design] methods employ the increasing power of computers.¹²⁵

One paramount result of using computation is the externalizing of design thinking and knowledge. Externalizing enables the recording and preserving of culture in carnival by making design knowledge explicit, enabling it to be transmitted to others, to be developed, and to build on existing knowledge. Including CAD/CAM computer-aided tools in the design process will enable more time and resources to be spent on the generation, exploration, and evaluation of design alternatives, by reducing the total reliance on full scale, physical prototyping for feedback.

¹²⁴ Lucienne Blessing, "Comparison of Design Models Proposed in Prescriptive Literature," *Social Shaping of Design: The Role of Design in the Shaping of Technology. Commission of the European Communities* (1995): 187–212.

¹²⁵ Nigel Cross, *Engineering Design Methods: Strategies for Product Design*, 3rd ed (Chichester ; New York: Wiley, 2000)..

The integration of digital technology in the current design process will make for a less labor intensive means of costume design and construction. Design research, and the use of computational tools will allow the externalization of design thinking and knowledge, which speeds up knowledge transfer. The introduction of computational tools and digital technology in the design process will benefit from and capitalize on the younger generation's love of technology. The increased interest by youths due to the integration of computational tools, and the ability of women, children, the aged, and infirmed to now participate in the process will lead to increased involvement in the production of mas'. This increased involvement would result in more resources (human and time) to carry out more design explorations, and generate design alternatives. The ability to generate design alternatives, increase the speed of knowledge transfer, and have a more inclusive process will open up more possibilities for improving design in the Trinidad Carnival.

3.3 Summary of Analysis

In this chapter, I analyzed the components of design in the Trinidad Carnival using Engestrom's Activity System model as my theoretical framework. I described the roles of those involved in the design process, their object(ive)s, and the tools and artifacts that mediated this design process. I also gave insight and formulated a descriptive abstraction of the design process in the Trinidad Carnival. The interactions and social

activities in the design process, as well as the importance of the culture of Mas Camps in fostering those interactions were shown. After doing this, I developed models explaining the existing and desired situations, my line of argument, and the factors that I will be addressing in an attempt to solve the problem. The problems are (1) the dying art form of wire bending, (2) the lack of time and resources to generate design alternatives, (3) the lack of an inclusive design process, and (4) the lack of involvement by communities in making in carnival. The key factors I address are the labor intensive methods of costume construction, the externalizing of design thinking, and the younger generation's love of technology.

Chapter 4: The Grammar

- 4.1 Bailey-Derek Wire Bending Grammar
- Primitives in wire bending
 - Shape Rules



Drawing © Vernelle A. A. Noel 2011

4 Results

4.1 Wire Bending Grammar

This section introduces the use of Shape Grammars to capture the connections used in wire bending in Trinidad Carnival. The future goal of this is for its use in design education, the generating of diverse designs in wire bending using these connection rules, and employing the computer as a design tool. Shape Grammars are rule-based systems for describing and generating languages of visual or spatial designs.¹²⁶

Developed by Stiny & Gips (1971), they are a vocabulary of shapes or primitives that have specific transformation rules that determine how they are used.¹²⁷ I deploy shape grammars in my thesis because they are ideal for capturing and encoding the visual features of wire bending. They codify some of the knowledge in wire bending connections in such a way that it enables the use of computers to generate possible designs from these connections.

4.1.1 Primitives in wire bending

The main elements used by Stephen Derek in wire bending are aluminum flats, aluminum rods, wire, fiber glass rods, PVC rods, fiber glass tape, and cable ties (Figure 80). Structure and design determines the material to be used, since it depends on the weight the masquerader can carry.

¹²⁶ Knight, *Applications In Architectural Design, And Education And Practice*.

¹²⁷ George Stiny and James Gips, "Shape Grammars and the Generative Specification of Painting and Sculpture," in *Sciences & Humanities: Models and Applications for the Arts* (presented at the IFIP Congress, Ljubljana, Yugoslavia: North Holland Publishing Co, 1971).


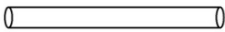





Aluminum Flats - (A)	
Aluminum Rods - (B)	
Wire - (C)	
Fibre Glass Rods - (D)	
PVC Rods - (E)	
Fibre Glass Tape	
Cable Tie	

Figure 80 – Primitives used in Wire Bending by Stephen Derek
Legend for shapes used in grammar

Aluminum Flats

The aluminum flats are the main structural elements used to construct the backpack for costumes and attachments for the feet. The backpack is worn by masqueraders and “carries” the costume. The aluminum flats are bent based on the form and dimensions of the person wearing it. Main aluminum flats run vertically on either side of a central axis - the human spine. They run from the front of the body - fitting over the shoulder - then to the waist. At this point they bend out over the buttocks. The horizontal aluminum flats run at four (4) locations; first approximately at the shoulder blades, and second at the middle of the back. The third location is the waist, and fourth where the horizontal flat extends beyond the vertical flats forming a curve that does not touch the

waist, but instead encloses space around the waist. The fourth horizontal flat connects the ends of the vertical flats at the buttocks together. Depending on the design, the masquerader, and the dynamism required of the costume, the vertical flats may terminate at the waist. Aluminum flats are connected to each other with blind rivets.

Aluminum rods

Aluminum rods can be connected to flats, wire, PVC rods, and fiber glass rods. They are structural elements secondary to the primary flats for the backpack. Aluminum rods extend from the backpack to create forms and shapes, which can extend vertically, horizontally, or even sloping and can bend in angles required of the design.

Wire

Wire has been traditionally used for form-making in costuming in Trinidad carnival. The gauge of wire used depends on how much weight the person carrying the costume is able to bear.¹²⁸ Higher gauges of wire are used on small persons, children, or those requiring lighter costumes. The gauge of wire used depends on how much weight the masquerader is able to carry, and what is best for performing the costume. Wire has little memory, and therefore keeps its form when shaped.

¹²⁸ Albert Bailey, Interview by Vernelle Noel, January 4, 2013.

Fiber Glass & PVC Rods

Fiber glass rods are used to give a bouncing effect to costumes. They are lighter than aluminum and wire and are used when the structure and design determines the weight to be carried. The choice of combinations of materials depends on the design, the weight the masquerader can carry, the decorations to be used, and most importantly, the movement desired of the costume.

Fiber Glass Tape

Fiber glass tape is the main component used to hold all elements in wire bending together; apart from blind rivets which are used on aluminum flats and rods. Some wire benders like Albert Bailey, use fiber glass tape as their first layer to secure the connections then wraps the fiber glass tape with masking tape. Bailey does this because fiber-glass tape sometimes "runs back," meaning, it sometimes unsticks from itself.¹²⁹ Stephen Derek on the other hand, uses only fiber glass tape in securing his connections.

Cable Ties

Cable Ties are used primarily to improve the stability and secure orthogonal connections between aluminum flats and aluminum rods. A cable tie is used before the application of fiber glass tape, for a more robust meeting of the two different geometries.

¹²⁹ Ibid.

4.1.2 Shape Rules for connections in wire bending

This wire bending grammar, which I shall name the Bailey-Derek Wire Bending Grammar, is a computational tool to capture the current tacit knowledge (situated knowledge) that resides in wire benders in Trinidad. The formalization of this grammar is just the beginning. Continued development and cataloguing of the connections and spatial relations in wire bending, as well as the exploration of different compositional aspects in wire bending is needed. There are currently twenty (20) rules in the Bailey-Derek Wire Bending Grammar, which capture the features of this unique, traditional artform. Rule 1 describes connections and spatial relations between same materials, for example, aluminum flat and aluminum flat, wire and wire. Rule 2 defines connections between aluminum flats and wire, Rule 3, illustrates connections between aluminum flats and aluminum rods. Rule 4 shows rod to rod (aluminum) connections, Rule 5, aluminum rod to wire connections and Rule 6, aluminum rod to non-wire materials such as fiber glass and pvc rods. Rule 8 demonstrates the spatial relation between wire and non-wire (fiber glass and pvc rods) materials, and Rule 9 exhibits the relation between non-wire materials.

4.1.2.1 Rule 1a

Rule 1a (Fig. 81) shows the spatial relation between aluminum flats. Their relation is a parametric one and connections are done with blind rivets.

RULE 1a - [A + A]

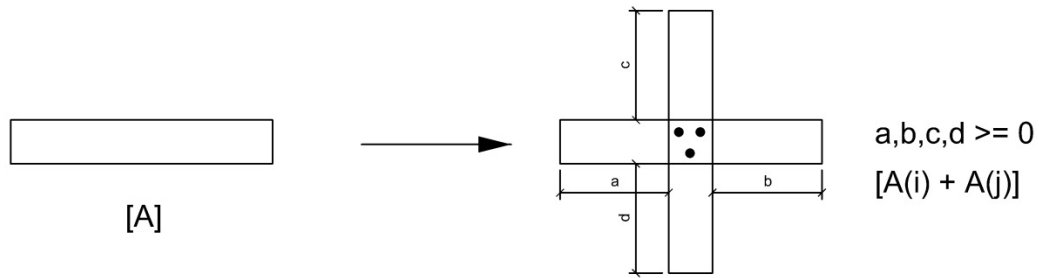


Figure 81 – Rule 1A

4.1.2.2 Rule 1b

Rule 1b (Fig. 82) shows the curled ends of a piece of wire. This shape is used for connecting different materials in wire bending.

RULE 1b - [C]



Figure 82 – Rule 1B

4.1.2.3 Rule 1c

Rule 1c (Fig. 83) illustrates the bending of one end of a piece of wire, which is also an element used in creating connections.

RULE 1c - [C]



Figure 83 – Rule 1C

4.1.2.4 Rule 2a

Rule 2a (Fig. 84) shows the spatial relation between aluminum flats and the end of a strand of wire. When wire is connected to aluminum flats, its end is curled (Fig. 80 – Rule 1c) before they are both wrapped in fiber glass tape. This prevents slippage of the wire and further secures their connection. The angle in which the wire lies in relation to the aluminum flat depends on the design.

RULE 2a - [A + C]

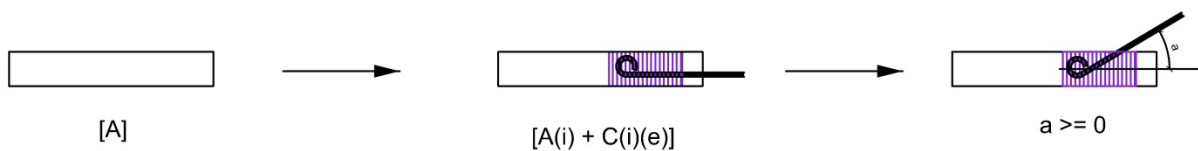


Figure 84 – Rule 2A

4.1.2.5 Rule 2b

Rule 2b (Fig. 85) shows the spatial relation between aluminum flats and the non-terminal points of a piece of wire. The wire is placed on the wide or narrow side of the aluminum flat. The entire unit as a whole is then secured together with fiber glass tape.

RULE 2b - [A + C]

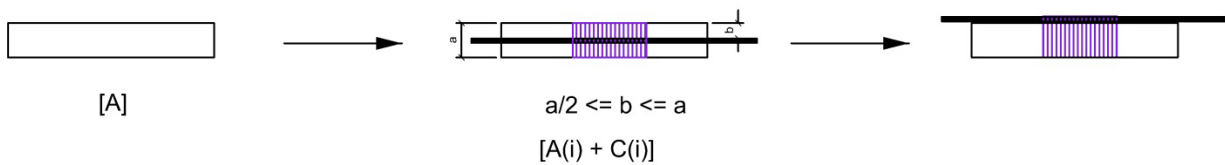


Figure 85 – Rule 2B

4.1.2.6 Rule 3a

Rule 3a (Fig. 86) shows the spatial relation between aluminum flats and the end of an aluminum rod. In this spatial relation the end of the aluminum rod is flattened by hammering, so that it lays evenly on the aluminum flat. The two elements are then blind riveted together. The angle of the aluminum rod depends on that required of the structure and design.

RULE 3a - [A + B]

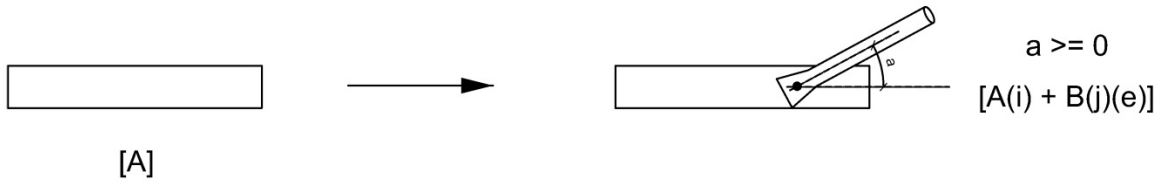


Figure 86 – Rule 3A

4.1.2.7 Rule 3b

Rule 3b (Fig. 87) shows the spatial relation between aluminum flats and aluminum rods. In this connection the flat and rod are cable tied together securely, and then all three components are further wrapped with fiber glass tape. Note that wrapping with the fiber-glass tape occurs in a crisscross manner (in the form of an X) several times, over and over, until the connection is robust.

RULE 3b - [A + B]

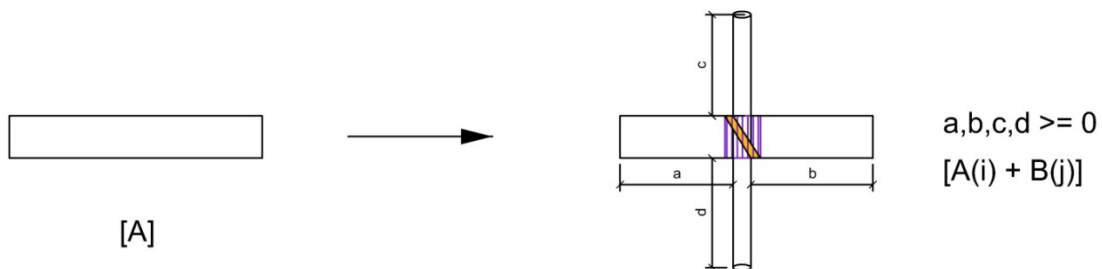


Figure 87 – Rule 3B

4.1.2.8 Rule 4a

Rule 4a (Fig. 88) shows the spatial relation between two aluminum rods placed side by side. The rods are wrapped securely in fiber glass tape for connection. Aluminum rods can be bent at any angle depending on the structure and the design.

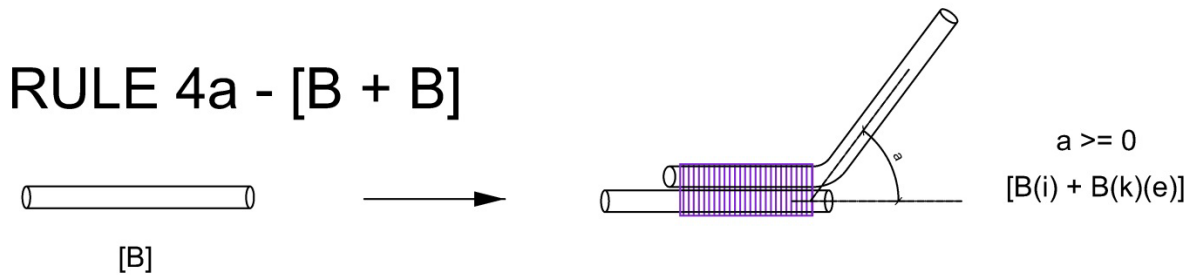


Figure 88 – Rule 4A

4.1.2.9 Rule 4b

Rule 4b (Fig. 89) shows the connection between two aluminum rods of different diameters. One rod is simply slipped into the other. If no movement is desired, fiber glass tape is used to secure the rods and prevent movement.

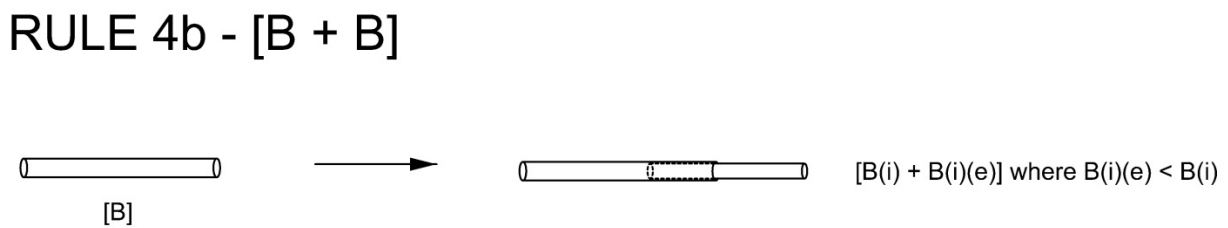


Figure 89 – Rule 4B

4.1.2.10 Rule 4c

Rule 4c (Fig. 90) shows the connection between two aluminum rods orthogonal to each other. Both rods are secured to each other using fiber glass tape. All orthogonal connections are wrapped with fiber glass tape in the form of a crisscross (X).

RULE 4c - [B + B]

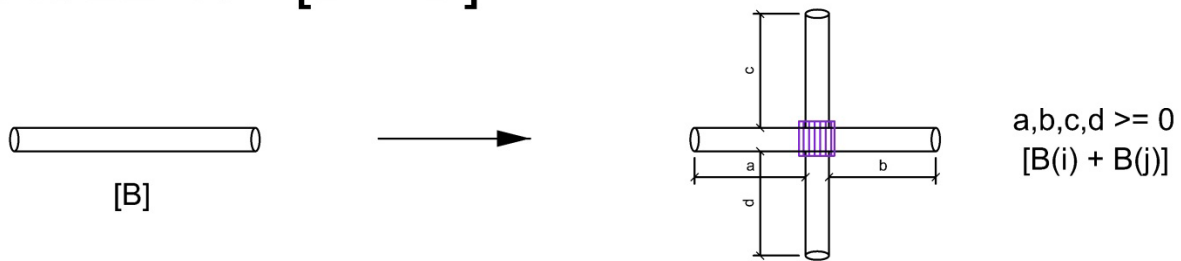


Figure 90 – Rule 4C

4.1.2.11 Rule 5a

Rule 5a (Fig. 91) is similar to Rule 2b except that the spatial relation is between an aluminum rod and wire (non-terminal point of wire). The wire is placed on the aluminum rod, and secured together with fiber glass tape.

RULE 5a - [B + C]

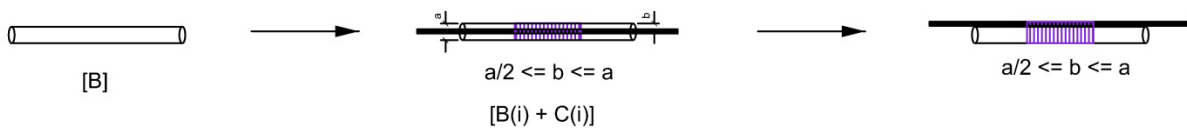


Figure 91 – Rule 5A

4.1.2.12 Rule 5b

Rule 5b (Fig. 92) shows the spatial relation between several combinations of aluminum rods, wire, fiber glass rods, and PVC rods. The combination and choice of material depends on that required of the design. Connections are secured with criss crossing fiber-glass tape.

RULE 5b - [B + C]

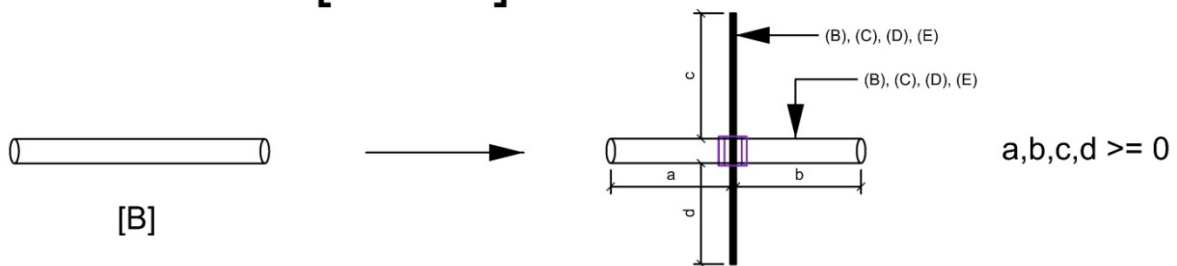


Figure 92 – Rule 5B

4.1.2.13 Rule 5c

Rule 5c (Fig. 93) shows the spatial relation between an aluminum rod and the end of a wire. Similar to Rule 2a, the end of the wire is bent before being placed on the aluminum rod. The two components are then secured by repeated wrapping with fiber glass tape.

RULE 5c - [B + C]

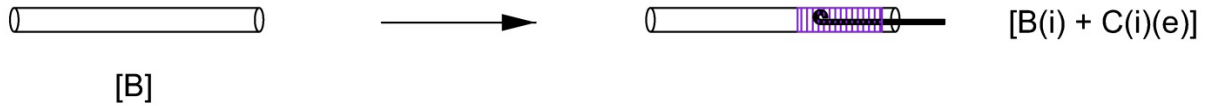


Figure 93 – Rule 5C

4.1.2.14 Rule 6a

Rule 6a (Fig. 94) shows the spatial relation between the end of an aluminum rod and the end of a fiber glass rod or PVC rod. In this spatial relation, Rule 1b is implemented on a piece of wire. This rule is used to connect the aluminum rod with the fiber glass or PVC rod. The wire is wrapped repeatedly with fiber glass tape to the aluminum rod and the fiber glass or PVC rod until secure. The angle that is required of the rod in the design is made by bending the wire to the angle desired, before wrapping with fiber-glass tape.

RULE 6a - [B + D] and [B + E]

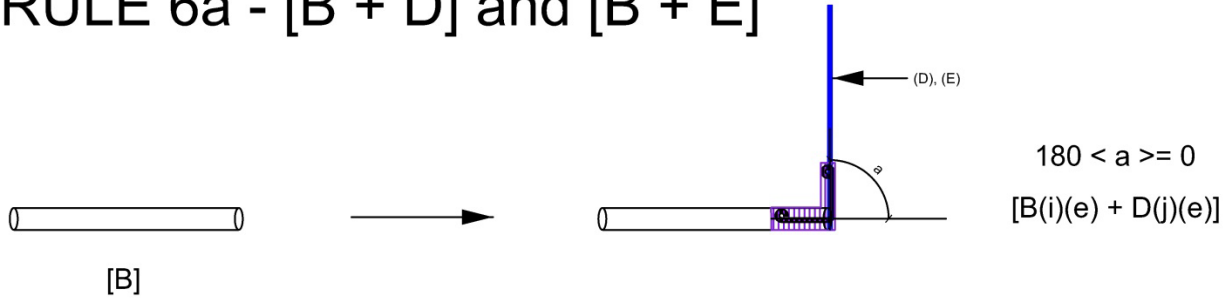


Figure 94 – Rule 6A

4.1.2.15 Rule 6b

Rule 6b (Fig. 95) shows the spatial relation between an aluminum rod and a fiber glass or PVC rod. One end of the aluminum rod is flattened by hammering to prevent the fiber glass or PVC rods from slipping out the other end. The fiber glass and PVC rod is then placed in the aluminum rod and secured with fiber glass tape. This rule can be used so that when one dances or moves the aluminum rod, their energy radiates through the movement of the fiber glass rod.

RULE 6b - [B + D] and [B + E]

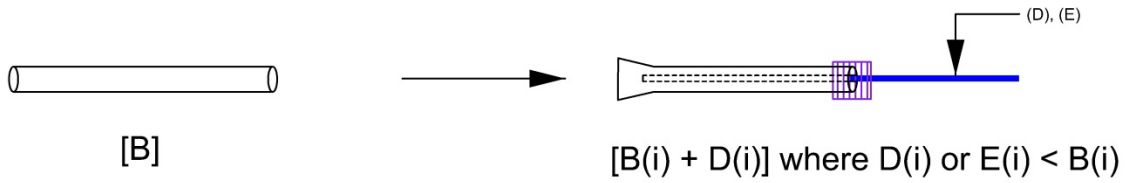


Figure 95 – Rule 6B

4.1.2.16 Rule 7

Rule 7 (Fig. 96, and 97) shows the spatial relation between the end of a wire and a non-terminal point along another piece of wire. The end of one wire is curved tightly around the body of the other.

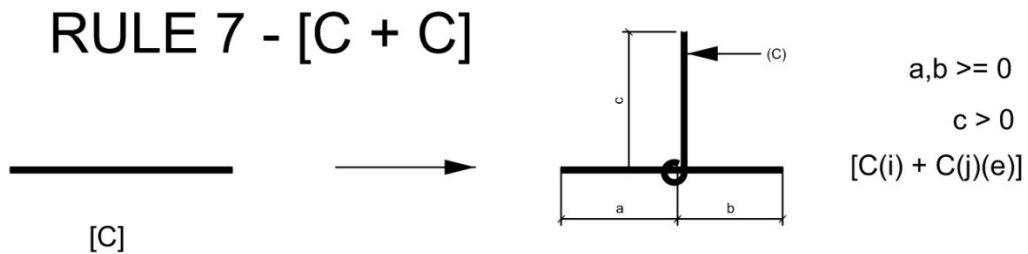


Figure 96 – Rule 7

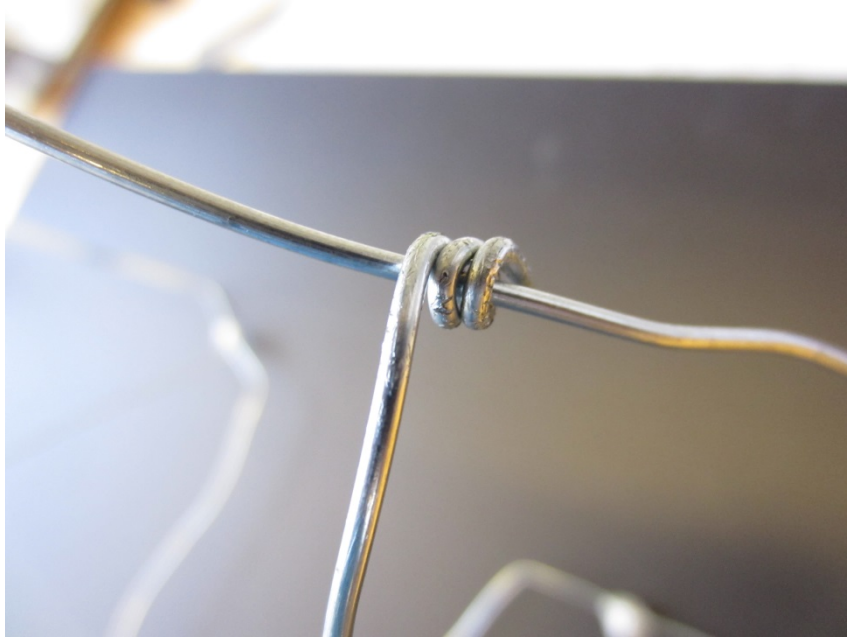


Figure 97 – Photo of Rule 7

4.1.2.17 Rule 8a

Rule 8a (Fig. 98) shows the spatial relation between wire and the end of a fiber glass or PVC rod orthogonal to each other. Rule 1c is used to connect the fiber glass or PVC rods to the wire. The rods are then secured to the wire with fiber glass tape.

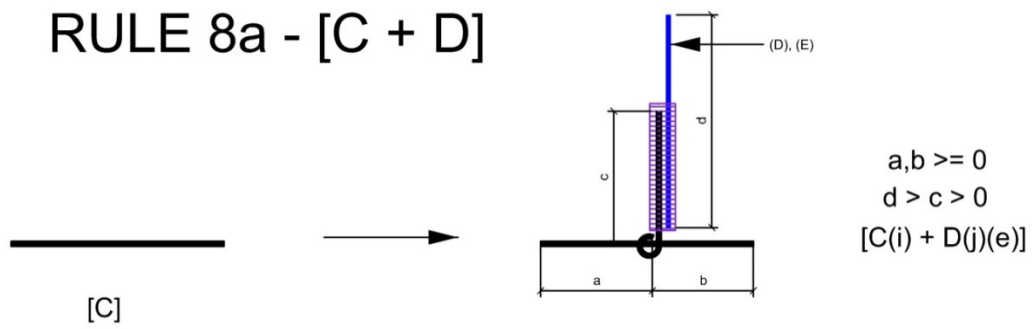


Figure 98 – Rule 8A

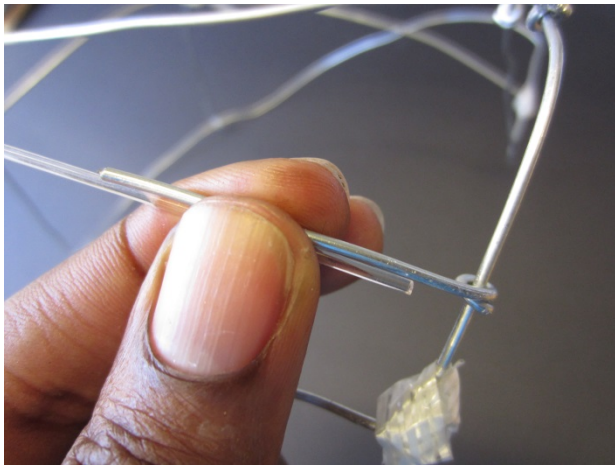


Figure 99 – Photo of Rule 8A

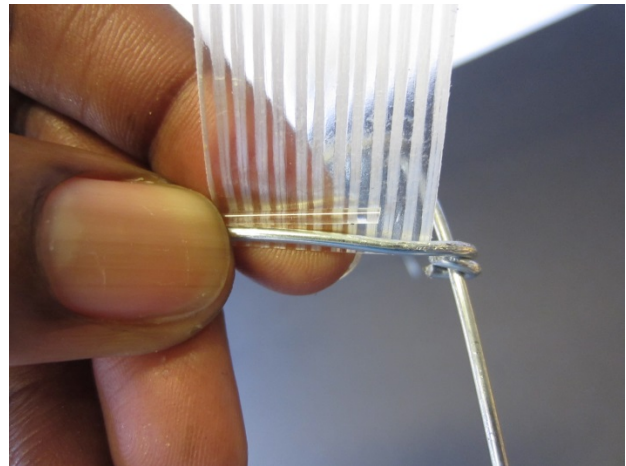


Figure 100 - Photo of Rule 8A

4.1.2.18 Rule 8b

Rule 8b (Fig. 101) shows the spatial relation between the end of a wire and the end of a fiber glass or PVC rod. Here the end of the wire is turned up and wrapped securely with fiber glass tape to the rod.

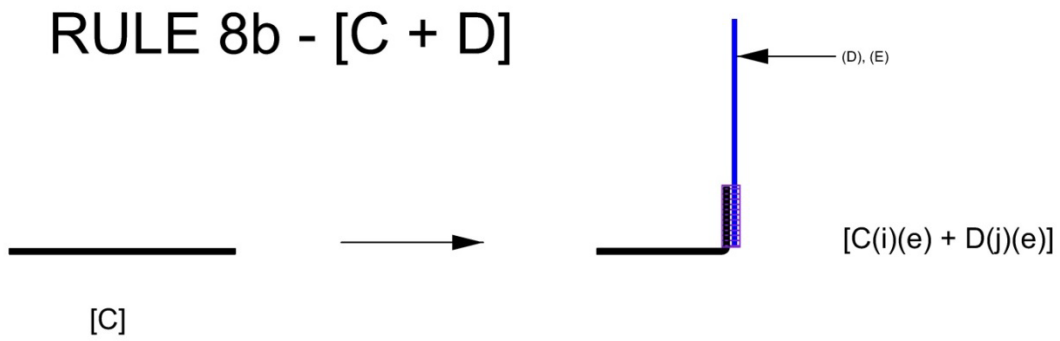


Figure 101 – Rule 8B

4.1.2.19 Rule 8c

Rule 8c (Fig. 102) shows the spatial relation between a wire and rods that are parallel to each other. They are both wrapped securely with fiber glass tape.

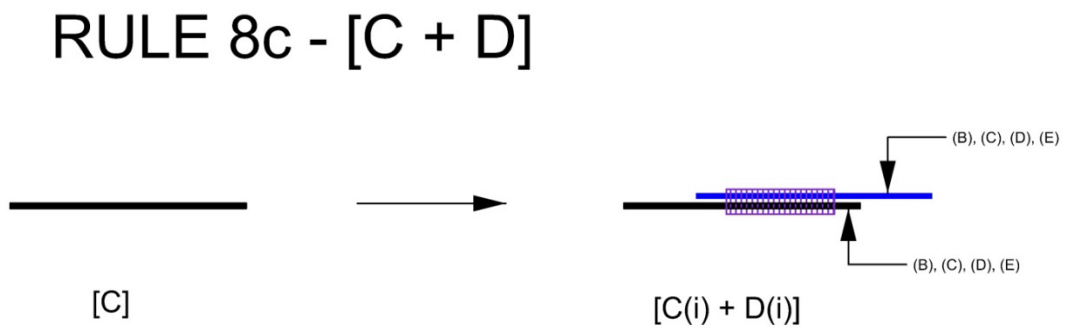
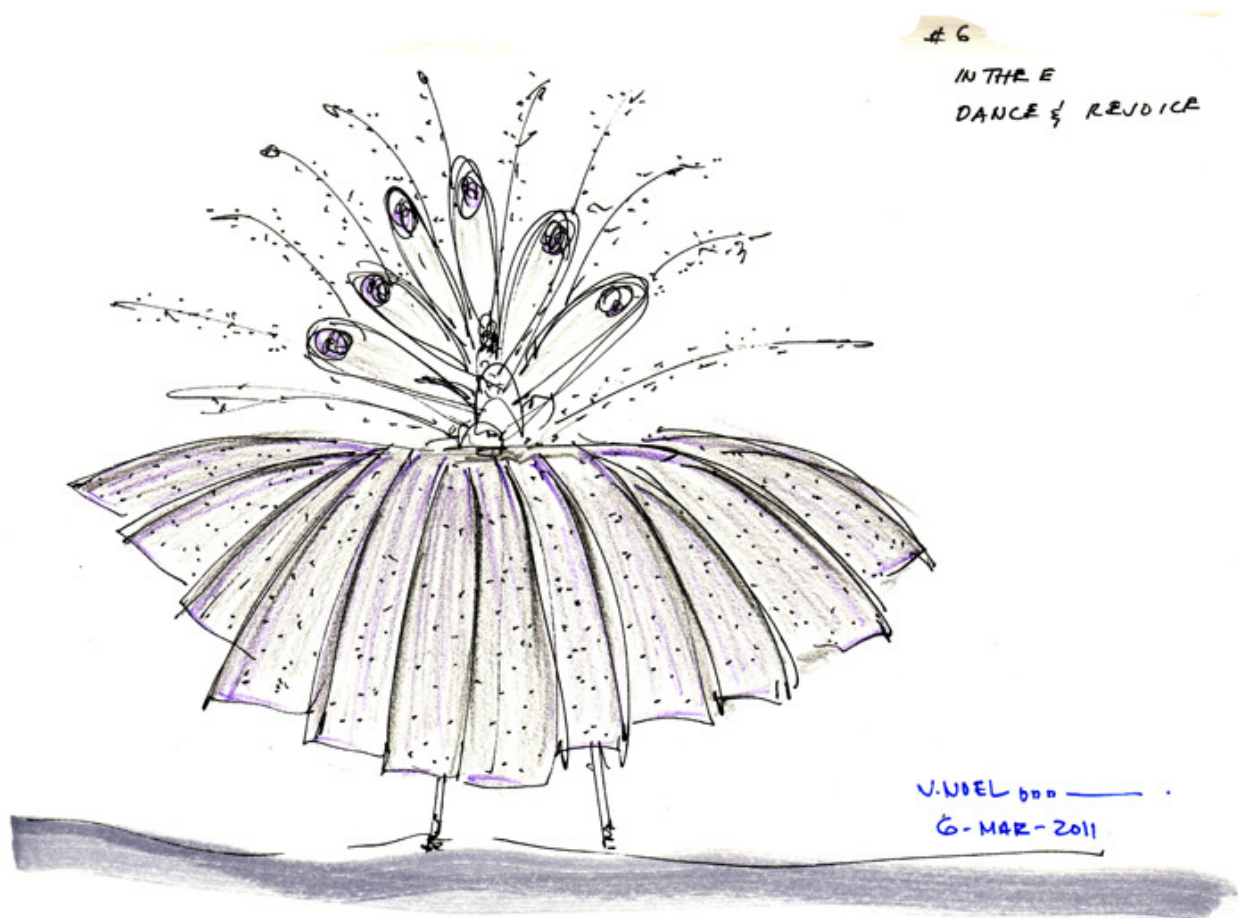


Figure 102 – Rule 8C

Chapter 5:

Experiment

- 5.1 Shape Grammars in design language
- 5.2 Digital Design Tools and Digital Fabrication



Drawing © Vernelle A. A. Noel 2011

5 Design Experiment

In this chapter I test the use of computation and digital technology in the design process in the Trinidad Carnival. I employ them for analysis, synthesis, and fabrication. I develop shape rules to compute and generate several design alternatives; and employ CAD/ CAM technologies for fabrication to create “objects to think with” when designing artifacts for the Trinidad Carnival.

5.1 Shape Grammars & Design Language

Peter Minshall is a mas’ man, artist, and designer whose work spans from 1974 to 2005 in the Trinidad Carnival. The foundation of Minshall’s work is the traditional Trinidad carnival character, the Bat (Fig. 6, and 7). He studied the kinetic principles of the Bat costume and how it expressed the performer’s energy. In his continued exploration of the Bat, he developed articulated wings in his designs. He abstracted the wing shapes into large segments of circles, creating a repertoire of winged mas creatures (Fig. 104, 105, 106, and 107) with “Hummingbird” in 1974.¹³⁰

¹³⁰ Todd Gulick, “Lifetime Achievement Award for Innovation in Arts & Culture - Nomination of Minshall,” July 18, 2000.



Figure 104 - "From the Land of the Hummingbird"
Peter Minshall (1974)
Photo courtesy Noel Norton



Figure 105 - "The Sacred and the Profane"
Peter Minshall, (1982)
Photo courtesy Noel Norton



Figure 106 - "Iron Bat"
Peter Minshall (1982)
Photo courtesy of Callaloo Company



Figure 107 - "The Sacred and the Profane"
Peter Minshall, (1982)
<http://arcthemagazine.com>

I examined a corpus of Peter Minshall's work based on the Bat, and recurring lines and shapes were culled. Through sketches I explored a conceptual language of designs, and spatial relations based on shapes of winged elements in designs (Figures 108 -113).

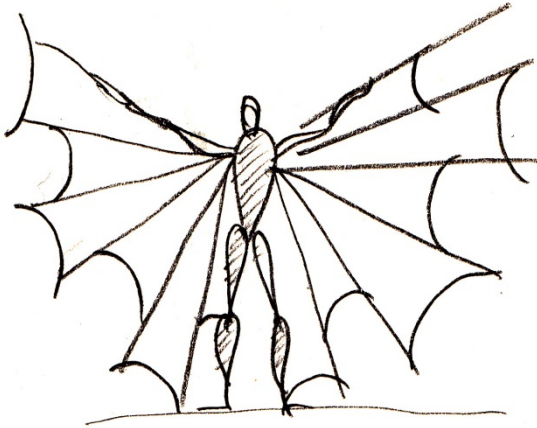


Figure 108 – Design Alternative 1
Sketch courtesy Vernelle A. A. Noel 2013

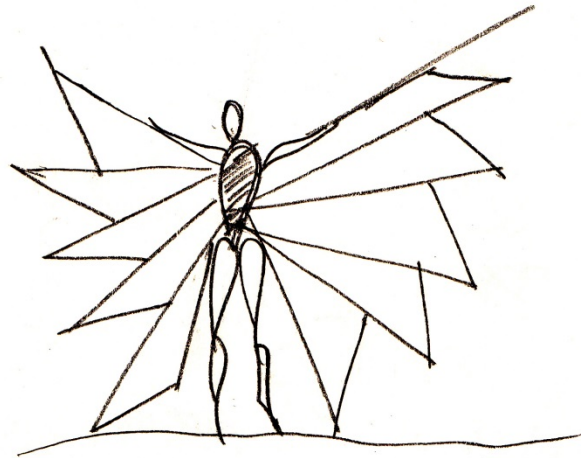


Figure 109 – Design Alternative 2
Sketch courtesy Vernelle A. A. Noel 2013

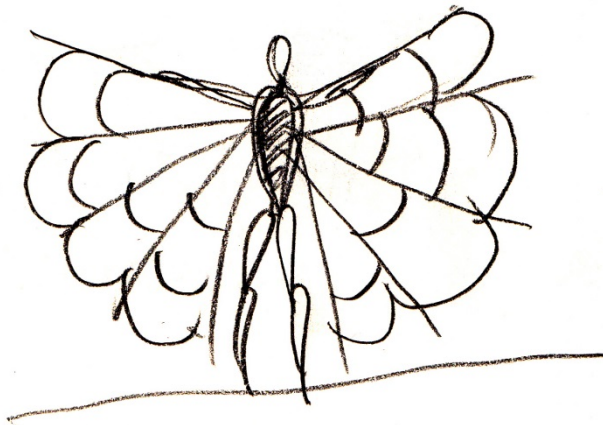


Figure 110 – Design Alternative 3
Sketch courtesy Vernelle A. A. Noel 2013

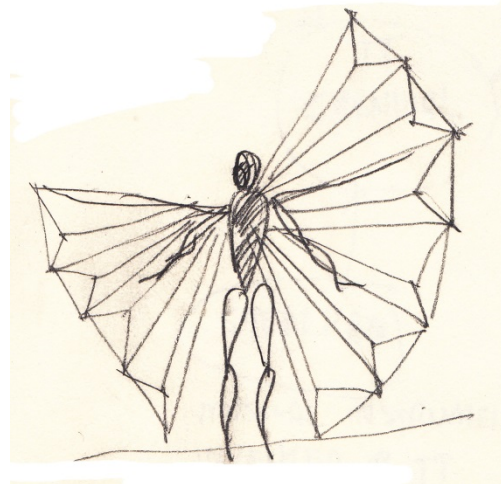


Figure 111 – Design Alternative 4
Sketch courtesy Vernelle A. A. Noel 2013

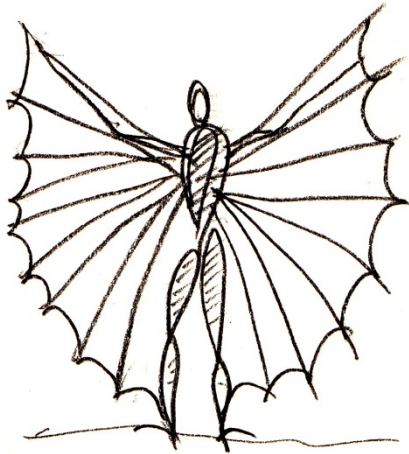


Figure 112 – Design Alternative 5
Sketch courtesy Vernelle A. A. Noel 2013

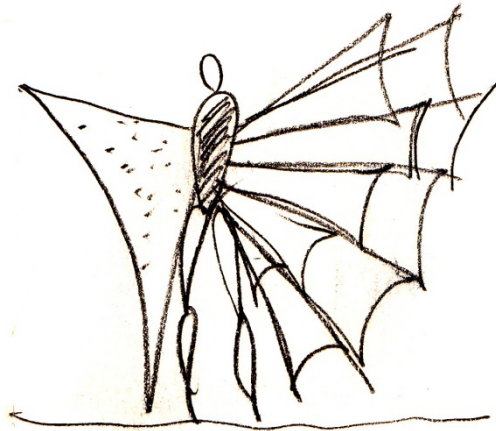


Figure 113 – Design Alternative 6
Sketch courtesy Vernelle A. A. Noel 2013

5.2 Digital Design Tools and Digital Fabrication

Using a digital design tool, I modeled a 3D shape, an antiprism. These shapes were developed and nested on a rectangle representing the size of the material from which I would be cutting to reduce material wastage. Test cuts were done before final cutting to obtain the correct power and speed settings required for quality cutting and scoring. Figures 114, 115, 116, and 117 illustrate the fabrication process.

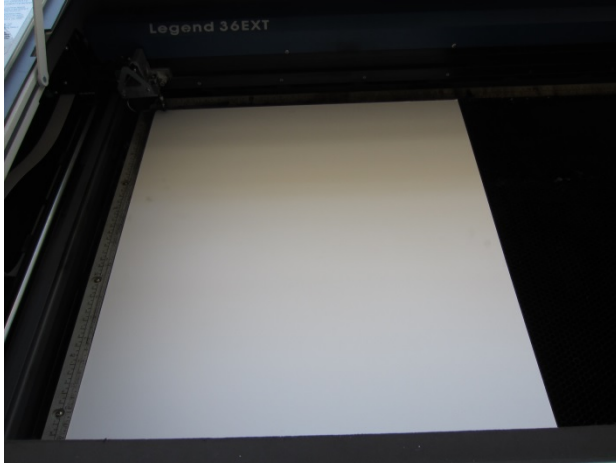


Figure 114 – Fabrication Process
The sheet of Bristol board placed on the bed of the laser cutter
Photo © Vernelle A. A. Noel 2013



Figure 115 – Laser Cutting
Observing the cutting by the laser cutter
Photo © Vernelle A. A. Noel 2013

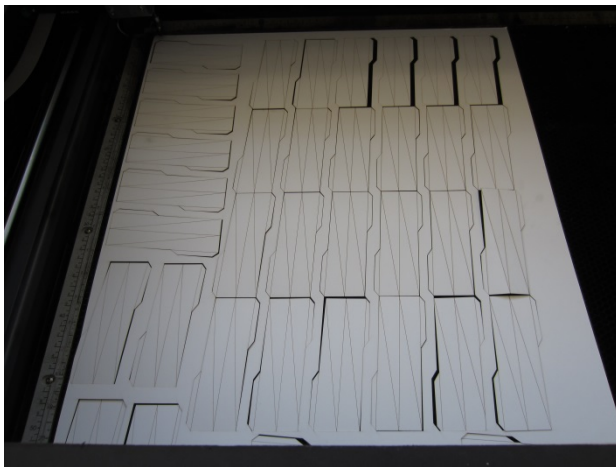


Figure 116 - Fabrication
Sheet of Bristol board after cutting complete



Figure 117 – Laser Cutting Machine
Laser cutter interface

Cutting one sheet with more than 30 shapes nested on it (Fig. 116), took 8 minutes and 37 seconds. When this is compared with the 3 hours it took me to wire bend the structure in Figs. 76 and 77, there is definitely motivation for investigation into how this can be used.



Figure 118 - Adhesive
Glue for sticking shapes



Figure 119 - Antiprisms
Shapes

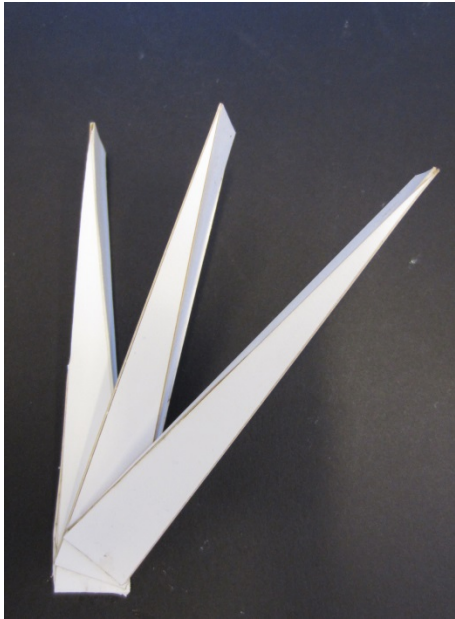


Figure 120 – Rule 1
Rule 1 - Bird of Paradise

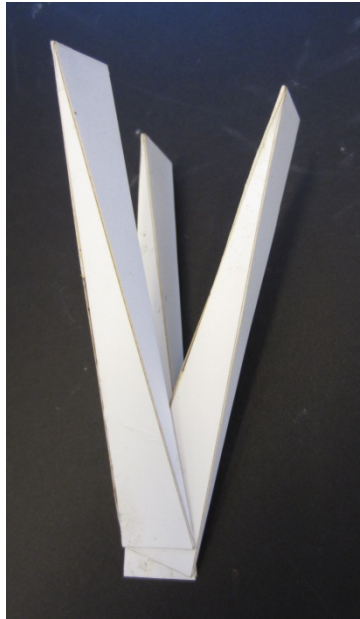


Figure 121 – Rule 2
Rule 2 - Dance the Bele

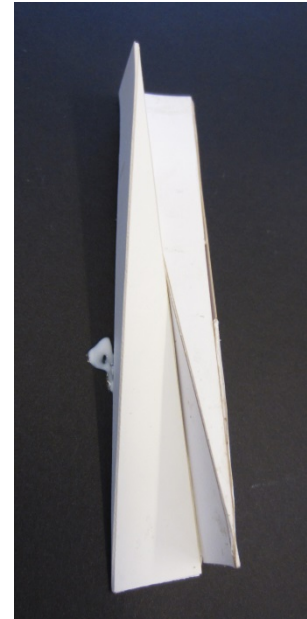


Figure 122 – Rule 3
Rule 3 - Midnight Robber

After assembling the shapes (Fig. 119), three shape rules were chosen (Fig. 120, 121, and 122) to create 3 different design variations.

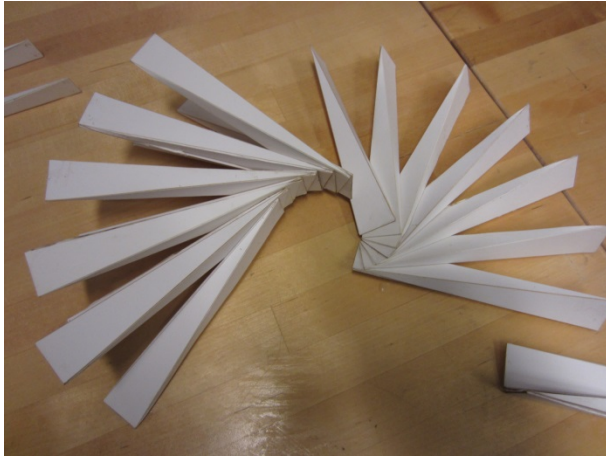


Figure 123 – Assembly of Rules

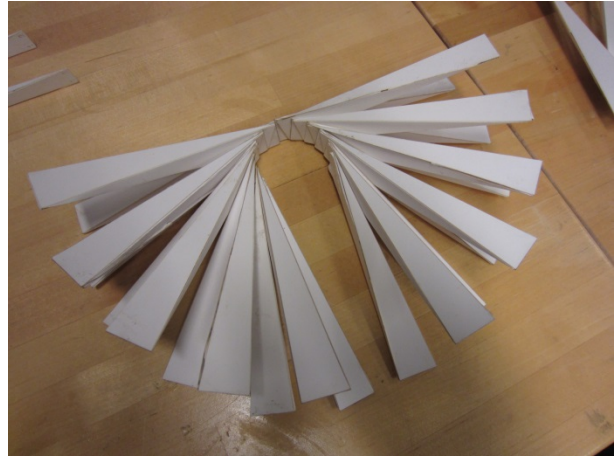


Figure 124 – Assembly of Rules



Figure 125 - Bird of Paradise
Rule 1 (Left View)
Photo © Vernelle A. A. Noel 2013



Figure 126 - Bird of Paradise
Rule 1 (Right View)
Photo © Vernelle A. A. Noel 2013

Figures 125 and 126 show the result of Rule 1, the Bird of Paradise. The computed design of this artifact can be used as an “object to think with” in the design process.



Figure 127 - Dance the Bele
Rule 2
Photo © Vernelle A. A. Noel 2013



Figure 128 - Dance the Bele
Rule 2
Photo © Vernelle A. A. Noel 2013

Figures 127 and 128 show the result of applying Rule 2, Dance the Bele.



Figure 129 - Midnight Robber
Rule 3 (Front View)
Photo © Vernelle A. A. Noel 2013



Figure 130 - Midnight Robber
Rule 3 (Rear View)
Photo © Vernelle A. A. Noel 2013

Figures 129 and 130 show the design computed using Rule 3, Midnight Robber.

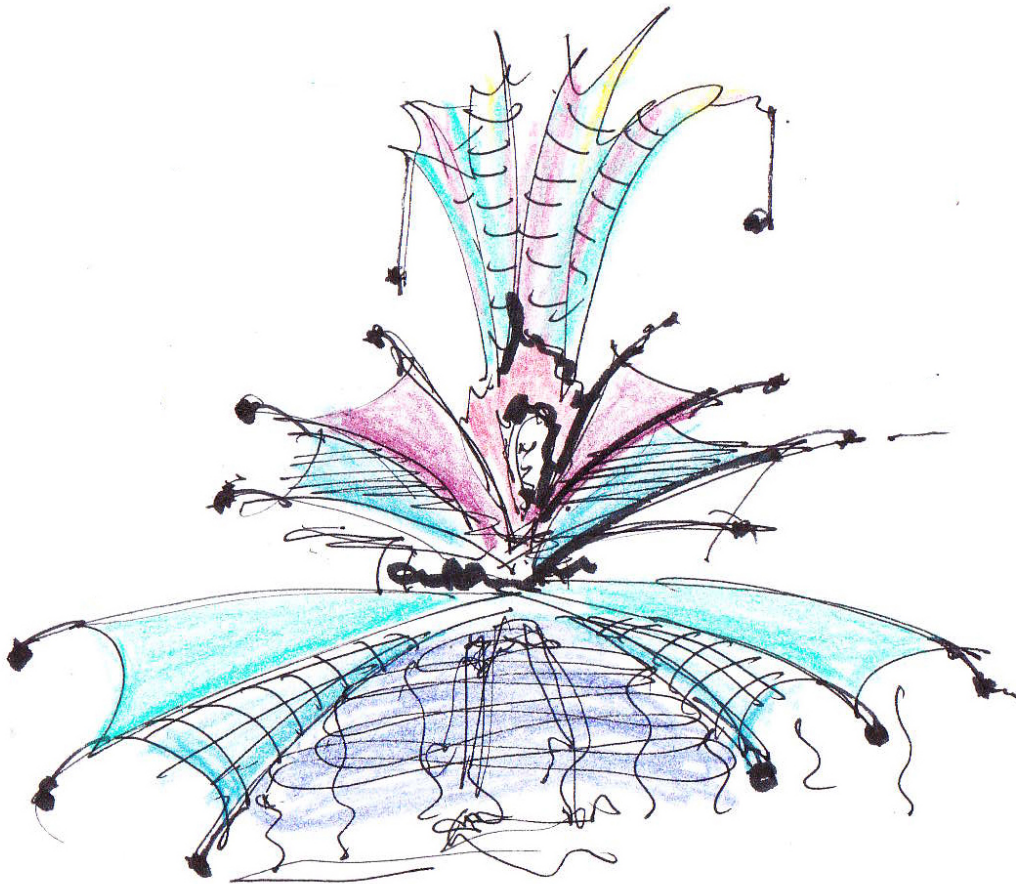


Figure 131 – Designs generated by computation
Three designs of the same design language borne from different shape rules
Photo © Vernelle A. A. Noel 2013

The integration of computational tools in this domain enables the generation of several design alternatives which when coupled with time for evaluation of those alternatives, has a positive impact on the outcome.¹³¹ The artifacts above are computed designs generated by applying respective shape rules. The resulting artifacts can be used as “objects to think with” in the design process in Trinidad Carnival to construct knowledge, help individuals see and learn new things in new ways, engage mental faculties, sensory perceptions, and motor activities.

¹³¹ Blessing, “Comparison of Design Models Proposed in Prescriptive Literature.”

Chapter 6: Conclusions & Discussion



Vernelle A. A.Noel

Drawing © Vernelle A. A. Noel 2011

6 Conclusion & Discussion

6.1 Conclusion

This thesis establishes the Trinidad Carnival as a domain for design research; addresses a dying art form of wire bending; seeks to bring communities back in the creative act of 'making', and improve design in the carnival through the integration of computational tools and digital technology. My hypothesis was that the integration of computation and digital technology could prevent the disappearance of a traditional design art form (wire bending), improve design by generating design alternatives, and foster a more inclusive design process that can get the community involved in making.

My main argument was that the lack of explicit knowledge in wire bending and labor intensive methods of costume construction results in a reduced section of the population participating in the design process in Trinidad Carnival. This lack of participation and the younger generation's love of technology, then leads to reduced resources (time and people) to carry out design explorations and create design alternatives; which it is proven, leads to better solutions and positive impacts on the outcome.

Research was carried out using Engestrom's [1987] model of Activity Systems to best explain and analyze interactions in this activity of design in the phenomenon of Trinidad Carnival. The roles and activities of individuals in the design process, the tools used, the

interactions, and the design process was brought to the fore. In addition, I used the Design Research Methodology (DRM) to gain a comprehensive understanding of the existing situation before developing support. Field research, interviews, study of literature and video, and participation in the process helped me gain an understanding of the status quo. Models explaining the situation in design, the key factors, where I introduce support and my line of argumentation in the Trinidad Carnival was created. A review of literature on the Trinidad Carnival, the application of computational tools to support cultural values, and the power of objects for thinking, and constructing knowledge was also discussed.

I developed a Shape Grammar, named the Bailey-Derek wire bending grammar to document and formalize aspects of the traditional art form of wire bending. This is a tool that can be used for education and further development of this unique art form. I employed the computational tool, Shape Grammars, to analyze a corpus of existing designs, develop hypothetical designs, and with digital fabrication methodologies, create "objects to think with" in the design process. It was important to do this research in order to address cultural sustainability, the dying art of wire bending, to improve and further develop design in carnival, to establish it as a prestigious domain of and for design and creativity, and to open it up to other audiences.

6.2 Contributions

My contributions include:

1. Development of a grammar capturing technical features of wire bending for use in design education and practice.
2. Addressing the gap in design research in Trinidad Carnival.
3. Employing the DRM Research Methodology in cultural phenomenon of design in the Trinidad Carnival.
4. Proposal of a more inclusive design process that uses computation and digital fabrication.
5. Proposing the integration of computation and digital technology to bring communities together and foster collaboration, learning, team building, and creativity.
6. The application of computational thinking, tools, and methodologies in a cultural design activity.

6.3 Recommendations

Some of my recommendations to further develop, and improve the culture of design and design education in the Trinidad Carnival includes:

1. The establishment of workshops and/ or a Carnival Academy to teach wire bending and other skills specific to design and the industry of the Trinidad Carnival.

2. Making design activities part of the school curriculum to pass on the culture to upcoming generations and to express creativity and skills that can be applied locally, and globally.
3. Creation of organizations around those of the same skill or expertise, for example, designers, wire benders, and prototypist organizations. The purpose of this is for continued education, and ensuring shared goals and values are aligned.
4. Government support and prize-giving for carnival productions that are of high artistic value, technical skill, visual quality, intellectual richness, and that contribute to community development.
5. Tax incentives and grant programs to support the development and production of mas. For example, acquisition of space/ buildings for bands to produce large dancing sculptures for carnival.
6. A Carnival Museum, as was also called for by Errol Hill in 1972.¹³²

6.4 Limitations

1. The current cost of manufacturing technologies - I present this intervention with the guiding assumption that in the near future these CAD/ CAM machines will be cheaper and more accessible opening up the way for this process.

¹³² Hill, *The Trinidad Carnival*, 1972.

2. New skills to be learned and the application of digital design tools in this design domain (non-architecture/ engineering). This can be addressed through workshops, seminars, school curricula, etc.

6.5 Future steps

Some future steps from this thesis include:

1. Implementing the wire bending grammar in a generative manner, both digitally and physically.
2. Developing software for this domain of design and fabrication, for example, wire bending software.
3. Testing the use of “objects to think with” in the design process.
4. Testing other digital technologies in the design and fabrication of dancing sculptures.
5. Further research into the relations between the components in the activity system and their influence on design.
6. Research into how computation and digital technology can support cultural sustainability.

Glossary

1. Wire bending – a traditional art form from Trinidad used in the Trinidad Carnival.
Wire and other thin, flexible strands of material are bent and assembled to create forms and structure for costumes.
2. Mas - The term 'mas,' is a shortened form of masquerade. Usually referring to the costuming and street parade in carnival.
3. Computation - rule-based design for analysis and synthesis
4. Cannes brules or Canboulay - Canboulay is a reenacting of the days when enslaved Africans were driven with cracking whips, horns, shells, and cries urging them to put out fires on sugarcane plantations.
5. Calypso – the music and rhythm native to Trinidad.¹³³
6. Steelpan/ Steel drum – musical instrument invented in Trinidad & Tobago by the African working class from oil drums.¹³⁴
7. Bikini and beads - aesthetic of the costumes which may comprise a bikini top and bottom, with colorful beads, jewels, and feathers for decoration.
8. Mas Man – term to refer to one who designs carnivals and masquerades in carnival (costumes, performances, etc).
9. Kings and Queens of Carnival – large sculptures danced by performers for competition. Also called dancing sculptures or dancing mobiles.

¹³³ Martin, "Trinidad Carnival Glossary."

¹³⁴ Ibid.

Bibliography

- Aline, Virginie. Interview by Vernelle Noel. Emailed interview, October 30, 2012.
- Asokan, Ashwini, and Jonathan Cagan. "Defining Cultural Identities Using Grammars: An Exploration of 'Cultural Languages' to Create Meaningful Experiences." In *Proceedings of the 2005 Conference on Designing for User eXperience*. DUX '05. New York, NY, USA: AIGA: American Institute of Graphic Arts, 2005.
- Bailey, Albert. Interview by Vernelle Noel. Personal Interview, January 3, 2013.
- . Interview by Vernelle Noel. Personal Interview, January 4, 2013.
- . Interview by Vernelle Noel. Telephone Interview, July 2, 2013.
- Bakhtin, M. M. *Rabelais and His World, by Mikhail Bakhtin. Translated by Helene Iswolsky*. Cambridge, Mass. M.I.T. Press [1968], 1968.
- Blessing, Lucienne. "Comparison of Design Models Proposed in Prescriptive Literature." *Social Shaping of Design: The Role of Design in the Shaping of Technology. Commission of the European Communities* (1995): 187–212.
- Blessing, Lucienne T. M., Amaresh Chakrabarti, and Lucienne T. M. Blessing. *DRM, a Design Research Methodology [electronic Resource] / Lucienne T. M. Blessing, Amaresh Chakrabarti*. Dordrecht ; New York : Springer, c2009., 2009.
- Boer, N.-I., P.J. van Baalen, and K. Kumar. "An Activity Theory Approach for Studying the Situatedness of Knowledge Sharing." In *Proceedings of the 35th Annual Hawaii International Conference on System Sciences, 2002. HICSS*, 1483–1492, Jan.
- "Brooklyn Architect Creates 3D-Printed Dress for Dita Von Teese - Fort Greene - DNAinfo.com New York." *DNAinfo*. Accessed July 9, 2013.
<http://www.dnainfo.com/new-york/20130319/fort-greene/brooklyn-architect-creates-3d-printed-dress-for-dita-von-teese>.
- Brown, Ernest D. "Carnival, Calypso, and Steelband in Trinidad." *The Black Perspective in Music* 18, no. 1/2 (January 1, 1990): 81–100.
- Cagdas, G. "A Shape Grammar: The Language of Traditional Turkish Houses." *Environment and Planning B: Planning and Design* 23, no. 4 (1996): 443 – 464.
- Collins, Harry. *Tacit and Explicit Knowledge*. University Of Chicago Press, 2010.
- Copeland, Raedene P. "Bikini, Beads, and Feathers|| at Trinidad Carnival: The Voice of the Younger Generation." PhD, The University of North Carolina at Greensboro, 2010.
- Cross, Nigel. *Engineering Design Methods: Strategies for Product Design*. 3rd ed. Chichester ; New York: Wiley, 2000.
- Crowley, Daniel J. "The Traditional Masques of Carnival." *Caribbean Quarterly* 4, no. 3/4 (March 1, 1956): 194–223.
- Derek, Stephen. Interview by Vernelle Noel. Personal Interview, January 5, 2013.
- Dr. Jo-anne Tull. "Money Matters – Trinidad and Tobago Carnival 2005." Trinidad and Tobago, 2005.
http://www.academia.edu/326827/_Money_Matters_in_the_Trinidad_Carnival_.

- Duarte, José Pinto. "Towards the Mass Customization of Housing: The Grammar of Siza's Houses at Malagueira." *Environment and Planning B: Planning and Design* 32, no. 3 (2005): 347 – 380.
- Esau, Meiling. Interview by Vernelle Noel. Personal Interview, January 4, 2013.
- Frauenfelder, Liselle. Interview by Vernelle Noel. Personal Interview, January 9, 2013.
- Frederick, Robert. Interview by Vernelle Noel. Personal Interview, December 29, 2012.
- "Freedom Of Creation | FOC Textiles in Permanent Collection at MOMA | Pioneers in 3D Printed Designs." Accessed July 9, 2013.
<http://www.freedomofcreation.com/home/foc-textiles-to-permanent-collection-at-moma>.
- Gershenfeld, Neil. "How to Make Almost Anything - The Digital Fabrication Revolution." *Foreign Affairs* 91, no. 6 (December 2012).
- Green, Garth L., and Philip W. Scher. *Trinidad Carnival: The Cultural Politics of a Transnational Festival*. Indiana: Indiana University Press, 2007.
- Gulick, Todd. Interview by Vernelle Noel. Personal Interview, January 10, 2013.
- . "Lifetime Achievement Award for Innovation in Arts & Culture - Nomination of Minshall," July 18, 2000.
- Hackett, James. Interview by Vernelle Noel. Skype Interview, March 4, 2013.
- Hardman, Joanne. "Researching Pedagogy: An Activity Theory Approach." *Periodical of the Kenton Education Association* (n.d.): 65. Accessed May 26, 2013.
- Harris, Max. "The Impotence of Dragons: Playing Devil in the Trinidad Carnival." *TDR (1988-)* 42, no. 3 (October 1, 1998): 108–123.
- Hill, Errol. *The Trinidad Carnival*. London: New Beacon Books, 1997.
- . *The Trinidad Carnival: Mandate for a National Theatre*. University of Texas Press, 1972.
- . "Traditional Figures In Carnival: Their Preservation, Development and Interpretation." *Caribbean Quarterly* 31, no. 2 (June 1985): 14–34.
- . "Traditional Figures In Carnival: Their Preservation, Development And Interpretation." *Caribbean Quarterly* 31, no. 2 (June 1, 1985): 14–34.
- Honoré, Brian. "The Midnight Robber: Master of Metaphor, Baron of Bombast." *TDR (1988-)* 42, no. 3 (October 1, 1998): 124–131.
- Jonassen, David H., and Lucia Rohrer-Murphy. "Activity Theory as a Framework for Designing Constructivist Learning Environments." *Educational Technology Research and Development* 47, no. 1 (March 1, 1999): 61–79.
- . "Activity Theory as a Framework for Designing Constructivist Learning Environments." *Educational Technology Research and Development* 47, no. 1 (March 1, 1999): 61–79.
- Jones, Lesley-Ann. Interview by Vernelle Noel. Emailed interview, October 30, 2012.
- Knight, Terry. *Applications In Architectural Design, And Education And Practice*. Report for the NSF/MIT Workshop on Shape Computation. Massachusetts Institute of Technology, April 1999. <http://www.shapegrammar.org/education.pdf>.

- Knight, Terry, and Larry Sass. "Looks Count: Computing and Constructing Visually Expressive Mass Customized Housing." *Artificial Intelligence for Engineering Design, Analysis and Manufacturing* 24 (2010): 425–445.
- Liverpool, Hollis Urban. "Origins of Rituals and Customs in the Trinidad Carnival: African or European?" *TDR (1988-)* 42, no. 3 (October 1, 1998): 24–37.
- Martin, Carol. "Trinidad Carnival Glossary." *TDR (1988-)* 42, no. 3 (October 1, 1998): 220–235.
- Miller, Robert. Interview by Vernelle Noel. Personal Interview, January 9, 2013.
- Minshall, Peter. Interview by Vernelle Noel. Personal Interview, January 11, 2013.
- Museum, Groninger. *Iris Van Herpen*. Bilingual. EXHIBITIONS INT'L, 2012.
- Narine, Dalton. *Mas Man: The Complete Work*. Documentary. 2011 King Carnival Productions, n.d. <http://www.masmanthemovie.com/>.
- Nurse, Keith. "Globalization And Trinidad Carnival: Diaspora, Hybridity And Identity In Global Culture." *Cultural Studies* 13, no. 4 (1999): 661–690.
- Papert, Seymour. *Mindstorms: Children, Computers, and Powerful Ideas / Seymour Papert*. New York: Basic Books, c1980., 1980.
- Pearse, Andrew. "Carnival in Nineteenth Century Trinidad." *Caribbean Quarterly* 4, no. 3/4 (March 1, 1956): 175–193.
- Peters, Kristal. Interview by Vernelle Noel. Emailed interview, October 30, 2012.
- Pfeiffer, Diane. "Digital Tools, Distributed Making & Design." Master of Science in Architecture, Virginia Polytechnic Institute and State University, 2009.
- Piaget, Jean. *Genetic Epistemology. Translated by Eleanor Duckworth*. Woodbridge Lectures Delivered at Columbia University in October of 1968, No. 8. New York, Columbia University Press, 1970., 1970.
- Polanyi, Michael. *Personal Knowledge: Towards a Post-Critical Philosophy*. Corr. Ed. University Of Chicago Press, 1974.
- Powrie, Barbara E. "The Changing Attitude of the Coloured Middle Class Towards Carnival." *Caribbean Quarterly* 4, no. 3/4 (March 1, 1956): 224–232.
- "Projects | Running Fence." Accessed April 8, 2013. <http://christojeanneclaude.net/projects/running-fence#.UWMdmJPqmSo>.
- Reddy, Michael. "The Conduit Metaphor: A Case of Frame Conflict in Our Language About Language." In *Metaphor and Thought*, edited by Andrew Ortony, 164–201. Cambridge: Cambridge University Press, 1993.
- Richardson, Lari. Interview by Vernelle Noel. Personal Interview, January 8, 2013.
- Riggio, Milla Cozart, ed. *Carnival: Culture in Action - The Trinidad Experience*. 1st ed. Routledge, 2004.
- . *Carnival: Culture in Action—the Trinidad Experience*. New York: Routledge, 2004.
- Rose, Adele. Interview by Vernelle Noel. Emailed interview, November 7, 2012.

- Sass, Lawrence. "Synthesis of Design Production with Integrated Digital Fabrication." *Automation in Construction* 16, no. 3 (May 2007): 298–310.
- Sass, Lawrence, and Marcel Botha. "The Instant House: A Model of Design Production with Digital Fabrication." *International Journal of Architectural Computing* 4, no. 4 (December 1, 2006): 109–123.
- Schechner, Richard, Milla C. Riggio, and Peter Minshall. "Peter Minshall: A Voice to Add to the Song of the Universe: An Interview." *TDR (1988-)* 42, no. 3 (October 1, 1998): 170–193.
- St. George, Roland. Interview by Vernelle Noel. Personal Interview, January 6, 2013.
- Stegassy, Ruth. "John Cupid: We Have Been Called Carnival People: An Interview." *TDR (1988-)* 42, no. 3 (October 1, 1998): 96–107.
- Stiny, G., and W. J. Mitchell. "The Grammar of Paradise: On the Generation of Mughul Gardens." *Environment and Planning B: Planning and Design* 7, no. 2 (1980): 209 – 226.
- Stiny, George, and James Gips. "Shape Grammars and the Generative Specification of Painting and Sculpture." In *Sciences & Humanities: Models and Applications for the Arts*. Ljubljana, Yugoslavia: North Holland Publishing Co, 1971.
- Tang Kai, Anthony. Interview by Vernelle Noel. Personal Interview, December 28, 2012.
- Turkle, Sherry. *Evocative Objects: Things We Think with / Edited by Sherry Turkle*. Cambridge, Mass. : MIT Press, c2007., 2007.
- . *Evocative Objects: Things We Think With*. MIT Press, 2007.
- Wuest, Ruth. "The Robber in the Trinidad Carnival." *Caribbean Quarterly* 36, no. 3/4 (December 1, 1990): 42–53.

Appendix

Questions for Designers, Artists, Prototypists

1. Describe the processes you employ in the design of your work?
2. What processes are employed in the making?
3. Do you begin your design from a concept or story? Where do they come from?
4. What are some problems you always run into in your work?
5. Do you use digital technology in your work?
6. Describe your process from design to production?
7. What processes do you employ for making your designs?
8. Is technology used in your communication with your design team?
If so, how is it used? How does it affect the (design, making) process?
9. What are the roles and responsibilities of those on the team from concept to completion?
10. What limits do you face in carrying out your desire? What are some limits to the technology currently available that you encounter?
11. What technologies have you seen and wished you had access to? Why? How would you use it?
12. Who are your favorite designers? People whose work inspires you, doesn't need to be purely carnival related.
13. What elements are signatures/ key/ or unique to your work?

Questions for Masqueraders

1. What is Carnival to you? What is its effect on you? How does it affect you?
2. How do you decide which band you play mas with?
3. How important is the design of a costume to your decision of who to play with?
4. Which matters more the costume or the experience? Elaborate..
5. Are the Kings & Queens of carnival (large dancing mobiles) fascinating to you? Explain your answer
6. Do you think the "making" of mas is being lost? Explain..
7. Who are your favorite mas makers, and why?
8. Give me your thoughts on the Carnival industry
9. What features (if any) stand out to you in the designs of costumes and large scale dancing mobiles?
10. Do you think our carnival artifacts (costumes & large scale mobiles) are pushing the boundaries of design, technology, innovation and education? Explain
11. What have been some of you favorite carnival artifacts?
12. Describe as best as you can for me your experience, feeling, when 'dancing' a mas.
14. Describe your interaction with costumes (those you wear, see, etc) and with the Kings & Queens when you see them on the street or in QPS.
16. What is your favorite part of the costume?
17. What are some issues (things you would like changed) about the carnival artifacts you wear?
18. What are the characteristics/ elements you love about them?
21. Have you noticed a change/ evolution in carnival artifacts over the years? Elaborate
22. What changes/ improvements would you like to imagine/ see in the craft/ art/ design of carnival artifacts? And the industry?
23. Does it matter to you how a costume is made?
24. Does it matter to you if costumes are made in T&T, or imported from other countries?
25. Have you ever had the privilege of seeing a carnival artifact created? What was the experience like?
26. What happens to your costumes at the end of carnival that year?
27. Is the costume you choose an expression of your personality?