

BOGGS, ADRIAN HUBBELL, M.S. Substance: Sustainable Design Through Positive User/Object Relationships. (2009)
Directed by Robert Charest. 97 pp.

The work of contemporary designers has increasingly come under scrutiny for its apparent disconnect with affairs of the greater human condition and status. This disconnect is evidenced in the design and development of products and materials that endanger the natural resources on which we depend, as well as the intentionally short lifespan of these products in the name of profit generation. Given the history of product design and its intended purpose of commodity, design scholars have suggested that a massive change within the practice and vision of design must occur in order to prevent the continued misuse of resources, and to reverse the apparent lack of connection between users and objects which has inevitably led to excessive disposal and waste. This thesis is an exploration of design process and material re-use, and examines the capacity of the designer to experiment with and embed within a product the physical, emotional and philosophical attributes that might strengthen the user/object connection. Given the timeframe of the exploration, a method for verifying the successful implementation of these traits was not developed. However, the opportunity to experiment with and consider these traits has led to the development of a prototype of sustainable furnishings, which has provided valuable feedback for future work.

SUBSTANCE: SUSTAINABLE DESIGN THROUGH POSITIVE
USER/OBJECT RELATIONSHIPS

by

Adrian Hubbell Boggs

A Thesis Submitted to
the Faculty of the Graduate School at
the University of North Carolina at Greensboro
in Partial Fulfillment
of the Requirements for the Degree
Master of Science

Greensboro
2009

Approved by

Committee Chair

APPROVAL PAGE

This thesis has been approved by the following committee of the Faculty of the Graduate School at The University of North Carolina at Greensboro.

Committee Chair _____

Committee Members _____

Date of Acceptance by Committee

Date of Final Oral Examination

TABLE OF CONTENTS

	Page
LIST OF FIGURES	iv
CHAPTER	
I. INTRODUCTION	1
II. SIGNIFICANCE	3
III. REVIEW OF LITERATURE	6
Consumption and Consumerism.....	8
Aesthetics, Materiality and Surface.....	12
Design Education and Design For Human/Object Interrelation.....	14
Analysis of Potential Emotional Traits.....	16
Overview	24
IV. METHODOLOGY	26
Ideation: Concept/Generative Drawings	30
Ideation: Form and Sketch Models.....	31
Feedback and Review.....	33
Final Selection.....	34
Materiality: Origin and Significance	35
Fabrication.....	37
V. CONCLUSION	42
Object Characteristics.....	42
User/Object Relationship.....	45
REFERENCES.....	47
APPENDIX A: FIGURES	49
Figures: Generative Phase Drawings.....	49
Figures: Generative Form Models.....	77
Figures: Fabrication and Final Product	89

LIST OF FIGURES

	Page
Figure 1: Generative Phase Drawings	49
Figure 2: Abstract Form Model	78
Figure 3: Abstract Form Model	78
Figure 4: Abstract Form Model	79
Figure 5: Abstract Form Model	79
Figure 6: Abstract Form Model	80
Figure 7: Abstract Form Model	80
Figure 8: Abstract Form Model	81
Figure 9: Abstract Form Model	81
Figure 10: Abstract Form Model	82
Figure 11: Typology Form Model	82
Figure 12: Typology Form Model	83
Figure 13: Planar Form Model	83
Figure 14: Planar Form Model	84
Figure 15: Planar Form Model	84
Figure 16: Form Model	85
Figure 17: Form Model	85
Figure 18: Form Model	86
Figure 19: Form Model	86
Figure 20: Form Model	87

Figure 21: Form Model	87
Figure 22: Form Model	88
Figure 23: Glue-up and clamping.....	90
Figure 24: Glue-up and clamping.....	90
Figure 25: Glue-up and clamping.....	90
Figure 26: Rough/general shaping.....	91
Figure 27: Rough/general shaping.....	91
Figure 28: Rough/general shaping.....	91
Figure 29: Boundary shaping	92
Figure 30: Boundary shaping	92
Figure 31: Boundary shaping	92
Figure 32: Final shaping and sanding.....	93
Figure 33: Final shaping and sanding.....	93
Figure 34: Final shaping and sanding.....	93
Figure 35: Stain application.....	94
Figure 36: Stain application.....	94
Figure 37: Final product	95
Figure 38: Final product	95
Figure 39: Product detail	96
Figure 40: Product detail	96
Figure 41: Product detail	97
Figure 42: Product detail	97
Figure 43: Product detail	97

CHAPTER I

INTRODUCTION

This thesis revolves around the current state of affairs regarding the sustainable design of interior products and furnishings. The goal of sustainability is to consider and respect all aspects of the impact of human action, with the intent of decreasing the human “footprint” on the planet, thereby ensuring the survivability of the species. Within this philosophical structure, the goal of sustainable design is to maintain an awareness of the impact of human actions on the planet, specifically regarding product design and use, and work toward the development of products and objects that lessen this impact. To achieve the result of lessened impact, various methodologies have been employed, including the increased use of recycled materials, as well as the growing use of sustainably produced and derived materials. However, although these techniques have been in use for some years the problem of overflowing landfills continues to worsen. It is at this juncture that designers from around the world have begun to recognize that the problem cannot be solved solely with sustainable processes and materials, and thus have argued that objects must be designed to promote a positive user/object bond. This bond results in prolonged product ownership and therefore lifespan, thereby decreasing the demand on natural resources used in the manufacturing of more products, while simultaneously decreasing the flow of useful materials and objects bound for landfills. While some may see this as detrimental to the economy by potentially decreasing the amount of goods sold and thus

impacting the economy at large, there are opportunities to offset this impact by encouraging economic growth in the fields of sustainable material production and responsible material recycling and reuse.

This thesis and resulting body of design work focus on a review of the design process as it relates to the emotional factors of object ownership. Specifically, this thesis addresses the questions designers will have regarding the most effective ways to strengthen the user/object relationship using certain visual and emotional traits. Additionally, it explores the body of knowledge relevant to the topic of design for sustainability, with the intent of applying this knowledge to the design process. The end goal is the creation of a prototype product that reflects the core tenets of sustainability, promoting an emotionally satisfying user experience. In order to test long-term user/object satisfaction, a multi-year study of product ownership would have to be conducted. Given the short length of time available for the design and fabrication period, this thesis does not include a post-occupancy or ownership evaluation intended to generate empirical evidence regarding the positive user/object conditions within interior products. It is intended, rather, to serve as a design exploration in which these positive traits are considered in an experimental light for future reflection.

CHAPTER II

SIGNIFICANCE

When discussing the nature of sustainable design, the conversation almost always returns to its origins in human need and socio-cultural attitudes. It is the value set of a particular culture that determines or guides so many of that culture's actions regarding the material and resources used in the creation of objects. Much has been written about the rationale of human consumption, and it has long been agreed upon that daily, or survival consumption (not to be confused with over- or hyper-consumption) is the benchmark of successful human experiential development. Certainly, the forces of intensive marketing and advertising have had significant impact on the nature of consumerism in the West, and any attempt to embed sustainability in the mainstream cultural practice of the United States will have to consider heavily the effect of high-powered marketing on the general population of users. Scholars who have written about design for sustainability share the opinion that in order to truly integrate ecologically sustainable practices and lifestyles within the society at large, there must be change in the way that we as designers create products; one must consider not only the materiality and process of manufacturing, but also the very way and reasons for an individual's particular emotional bond with a given product. This consideration of the emotional and cultural characteristics of user/object bonding is critical to designing objects that endure the oscillation of trends and styles, continue to perform their intended function, and manage to stay out of landfills. In short,

this consideration is critical to the design of sustainable objects.

There is little question that designers, as makers of objects for the built environment, have a significant impact on society and its consumption patterns. Born in the Industrial Revolution, the practice of Product Design filled a need created by the technology of mass production for objects that could be manufactured through various emerging technologies. Product design lies at the center of three seemingly unrelated human energies: the rational and empirical spheres of technology and engineering, the esoteric and aesthetic sphere of art and human expression, and the function and growth of consumer culture.

Currently, “eco-design” or “sustainable design”, as commonly instructed, revolves around the incorporation of responsibly produced materials and efficient, resource-friendly processes. As indicated by the writings of numerous design scholars, such as Jonathan Chapman, Stuart Walker and Victor Margolin, this method of design (as a process) more resembles an afterthought to the function rather than a clear, integrated approach to the challenge of responsible object design. The solution cannot be successfully “tacked on” to the end product through the selection of environmentally conscious materials and processes. While these considerations are critical to the development of responsible objects, the true center of sustainability lies within a designer's thorough understanding of the emotional and cultural connection between user and object. In short, the process of sustainability must be integrated fully in the entire process of design, from ideation and concept to point-of-purchase. This study will explore the process of sustainable design as it relates to the design of interior objects and artifacts.

The net goal of the common characteristics of responsibly designed objects is the establishment of a durable and beneficial connection between the user and the object. This connection can be established and cultivated by various methods, most of which focus on the fluid and emotional interactions that occur between a user and a favorite object or product, such as a teddy bear, a unique tool, or even a favorite pair of jeans. It is these characteristics that designers must strive to wholly and faithfully embed in the products that they will design; they embody the essence of what will inevitably determine the success or failure of the connection between user and object.

CHAPTER III

REVIEW OF LITERATURE

Critical to this project is the understanding of the subjective experience of the designer during the process of designing “sustainable objects”. As mentioned previously, the focus is on successfully considering the emotional aspects of human/object bonding, and then finding effective ways to integrate this consideration into the design process. At this stage, one must consider that every designer takes a unique look at not only the design project itself, but the world around us, and evaluates the net worth of the emotional connection that they are attempting to establish. Can the product be designed with unique traits that foster an emotional connection? What might these durable traits be? How should designers consider objects in an “emotional” way, and how do these considerations build positive human/object bonds? Certainly, designers will consider materiality, tactility, texture and numerous other physical characteristics in the process of design. As well, the realm of aesthetic satisfaction will place significantly in the process of achieving positive emotional connection. While product design is often determined by current trends, the impact of both the sensorial and contemplative aspects of aesthetics will ultimately shape the object. A successful design relies on the designer's ability (and willingness) to reference many inputs from varied backgrounds and fields of study or professional practice when considering object design (Chapman, 2005).

What the leading texts in sustainable design do not tell us is how we might actually integrate these emotional considerations or traits into the design process. Plainly stated, there are no guidelines for this, and the integration process will be a task for each designer to carefully consider, relying upon emotional, sensorial and artistic personal judgment. It is in this aspect that the importance of individuality in design education plays a critical role in creating positive user/object relationships. Throughout the scholarly debate on the topic of design for sustainability, the importance of a multi-disciplinary “cross-training” for design students is constantly emphasized. This basically refers to the exposure of young designers to multiple disciplines related to the design of human environments, including social sciences, philosophy and even cultural anthropology. This cross-training, in younger designers, is analogous to the perspective of older, more experienced designers who have seen and been exposed to more of “life”, giving them a broader reference for the understanding of human emotions and interpersonal experience. It is this experience and exposure that augments a designer's ability to integrate the necessary traits that will promote positive human/object emotional bonds.

When discussing the topic of sustainable design as it exists within the field of design at large, it is critical to discuss several interrelated topics, or subheadings within the larger scope of professional design. The primary issues that surfaced repeatedly in this research pertained mostly to the prevailing socio-cultural attitudes toward consumption and consumerism, the rather subjective considerations of aesthetics, materiality and surface in regards to sustainability, and the current state of design education as it relates

to the human/user-object experience.

Consumption and Consumerism

Consumption, be it that of oxygen and sustenance or of knowledge and experience, is a given in the course of human existence. Just as our bodies cannot function without the consumption of air, our minds lie undeveloped and fallow when starved of emotional and conceptual activity. The term 'consumption' has been used to describe all manner of human activity, from ecologically balanced community gardening to the rapacious and unchecked strip-mining of mineral ore. Consumption, in its multiple contexts, is defined not by nourishment, but rather by the socio-cultural activity and enlightenment critical to the successful development of the human persona. Over-consumption, or hyper-consumption, is the issue at the heart of design for sustainability.

It can be said that over-consumption is the product of several factors, including technological advances, enormous prosperity (based on global, regional and demographic factors), and an engineered human need fueled by contemporary marketing methods. Technology has evolved so much from the dawn of the Industrial Revolution to modern day. For example, work taking hours or days only one hundred years ago can now be completed in minutes or seconds. Prosperity in the Western Hemisphere has placed in the average citizen's hands the capacity to acquire nearly anything that is instinctively desired, with very little lead time. But prosperity is only an enabler; the emotional construct of “need” is played upon in consumer culture by marketing forces that recognize the opportunity to manipulate the cultural and emotional landscape to serve the

best interests of personal gain. Core to this operation of marketing is a basic understanding of the human psyche; it is an understanding of the need for humans to “belong” to and feel needed and respected by their native culture, as well as the need to seek experience and stimulation. In the search for cultural validation and representation, we accrete objects around us that we feel (and hope) represent who we are, or at least who we want to be. 'Having' provides an archaic means of possession by enabling the consumer to “incorporate” the meanings that are signified to them by a given object (Chapman, 2005, p.54). It is through this perspective that consumers are magnetically attracted to objects that represent the traits, characteristics and persona that they themselves wish to embody and possess.

Through these attractions, consumers literally move away from reality and embrace an abstracted materiality not at all grounded in financial or environmental logic. Jean Baudrillard describes this process or reality fabrication as *simulation*, rendering McDonald's a simulation of convenience and Nike a simulation of street-wise independence; consumption is motivated by a need for the simulation, rather than the physical products themselves (Chapman, 2005, p.27).

A critical component serving as the primary motivation of human action is “need”. Humans constantly assess their need based on their immediate and long-term survival situations, and these needs spur us to action when a lack is acknowledged or experienced. The ideology of consumerism emerges from, is founded in a sense of lack, and is a vital socio-cultural process (Chapman, 2005, p.30):

Consumption is founded on a lack – a desire always for something not there. Modern/post-modern consumers, therefore, will never be satisfied. The more they consume, the more they will desire to consume (Chapman 2005, p.38).

When discussing the driver of material consumption, it is understood in the disciplines of psychology and sociology that we are consumers of the meaning embodied in the objects we possess. On balance, the object or matter means very little; rather, these objects provide a carrier for the significant meanings that we ultimately desire to consume and assimilate. The design of products is effectively the practice of consciously (and sometimes unconsciously) embedding meaning into an object; a meaning that we as users and consumers wish to possess and thus identify ourselves with. Material consumption is fueled by intricate and manifold motivations based on social, cultural and personal experience, and, on balance, is not simply about acquiring more “stuff”. Consumption (throughout the ages) is an endless journey toward the ideal or desired self (Chapman 2005, p.111). Throughout the ownership of an object, consumers continually uncover layers of meaningfulness that represent the signifiers of ideal or desired self. In light of this interaction between user and object, designers must weave intricacy among the layers of an object in order to optimize the sustainability of this meaningfulness (Chapman, 2005, p.99). In understanding the challenge behind sustainable design, the design and design education community must come to terms with the fact that within a materialist culture, an individual will seek to use objects rather than language to express the substance of one's ego and personal constitution. To take this challenge seriously, the designer must understand the importance of embedding within sustainable objects the emotional characteristics that best embody the tenets of sustainability, eco-responsibility

and rationality.

In assessing the role of design for sustainability as it relates to hyper-consumption and the human/object experience, design must trip not only the aesthetic triggers that draw people to certain objects; design must also seek to establish and cultivate a narrative between user and object. This narrative is “written” by the user, and it is the story of interaction between the two as the relationship grows longer. This narrative must be grounded in empathy, which will form the strongest bond between the user and object (Chapman, 2005, p.67). Generally, most objects will generate at least a small amount of connection and empathy with a user. The lifespan of the object is intrinsically dependent upon the durability of this empathy. Waste, therefore, could be seen as a symptom of expired empathy: a failed relationship that led to the dumping of one by the other (Chapman, 2005, p.73). If consumers have no empathy for an object, they will have no desire to keep it. It makes no common sense to design for durability if the empathy that ultimately fuels the bond of ownership expires or is allowed to deplete. In focusing primarily on the physical and material characteristics of product aging, designers fail to observe the metaphysical attributes and meaning of durability. As creative professionals it is vital that we look not exclusively at the physicality of sustainability; we must strive to understand the motivations and drivers that sustain the empathy, meaning, desire and other metaphysical factors that greatly influence the duration of product lifespan.

Aesthetics, Materiality and Surface

In discussing the role of aesthetics in design for sustainability, it is important to understand that the word “aesthetics” in product design has often been used to represent only the basic visual appearance or styling of the product. According to the Concise Oxford Dictionary, the definition of aesthetics is “a set or principles of good taste and the appreciation of beauty”, which will have us wrestling with such abstracted and generalized terms as “beauty” and “taste” (Walker, V. 11, #3, 1995).

On the subject of sustainable design, there has been little solid indication of a standard “look” in the genre of sustainable design. Due to the fact that the classic definition of aesthetics revolves around the terms “beauty” and “taste”, a further or more comprehensive understanding of these terms in relation to product design is needed. Beauty, as we commonly understand it, represents at least physically the characteristics of form, color, texture and sensoriality that, when present in an object, evoke a satisfying emotional response that lies outside the realm of cognitive operation. They are characteristics that exist purely in the domain of emotional experience. Taste, as it might relate to product design, usually represents one's “personal attitude or reaction to an aesthetic phenomenon or social situation, regarded as either good or bad”, or more aptly, “the ideas of aesthetic excellence or of aesthetically valid forms prevailing in a culture or personal to an individual” (Oxford Dictionary, 1990).

These two uniquely different aspects of emotional and cultural experience represent the primary meaning behind the notion of aesthetics. With the intrinsic link between these two aspects in mind, we might consider a condensed, streamlined and

somewhat more product design-applicable definition of the aesthetics:

The aesthetic experience of an object is an interlinked and inseparable union between sensory response and contemplative experience. As a sensory response, the object is enjoyed for its combination of qualities such as shape, color, texture, that is, for its beauty. As a contemplative experience, the appearance of the object is studied from its significance and value; this can lead to a discriminating judgment, which is the basis of taste. (Walker, V. 11, #3, 1995)

This classification clearly indicates an inseparability of the sensorial qualities of an object from the contemplative qualities of the same object. Effectively the form that the object possesses is a function of the contemplative values or content that it represents. These values are formed through one's personal views, experiences and circumstances, leading to value judgments on significance, meaning and beauty that form one's own sense of aesthetic satisfaction.

If we take this definition of aesthetics and apply it to design for sustainability, we begin to recognize that the value sets that form our sense of right and wrong, responsible or irresponsible, and frugal or wasteful, are the prime movers behind the aesthetics of sustainability. We can see that our aesthetic experience when encountering an object is founded in both its form *and* content (Walker, V.11, # 3, 1995). The content of the object evokes our association, knowledge and understanding of the world in which we live. Our resonance with the form of an object is based on our personal and subjective opinions regarding beauty and attraction. Based on this understanding, our aesthetic rationale is then a function of our experiences and circumstances, as well as our geographical and cultural origins (Walker, V. 11, #3, 1995).

Considering this definition of the term, it becomes evident that the aesthetics of sustainability may not take any particular form, but rather would, through its visual content, communicate the characteristics of sustainability, such as longevity and durability, ease of maintenance, repair and upgrading, and product or component reuse (Walker, 2006). This leads directly to the discussion of surface and its role in design for sustainability. Surface can be an initial visual indicator for the user, informing them of the potential content of the object. The effective aim of surface in sustainable objects is to be durable, repairable, upgradable or recyclable; thus, surfaces that embody or represent properties contrary to this aim indicate a general lack of consideration on behalf of the designer regarding sustainability.

Design Education and Design For Human/Object Interrelation

The role of design in the promotion of sustainable human activity has been academically discussed and written on for over forty years. The responsibility of design to meet this challenge has only begun to be broadly acknowledged within the profession for the past fifteen to twenty years. As designers of consumer artifacts, we will face increasing moral pressure from within our field to embrace the task of responsible design and design for sustainability.

In discussing design for sustainability, it is important to outline the position of economics within the process. Product designers, since the dawn of the practice during the Industrial Revolution, have been an instrument of the system of mass production which enabled that system to flourish. Product Design was the much-needed outlet for the

multi-fold increase in production capacity afforded by the Industrial Revolution. This system was based on an ever-increasing production capacity and the need for design (and the fledging industry of marketing) to continually create “new” sales through the upgrading and improvement of existing products through advances in technology. This construct, based on theoretically unending growth, is commonly referred to as the “expansion” model of development. Naturally, it can be seen that this model does indeed have limits, some of which with we are coming in to direct conflict. Based on these inherent limitations, another model of development has begun to gain traction, at least conceptually, within our profession: the “equilibrium” model. Aptly named, this model of development implies that a natural balance between economics, human survivability and planet health is the most beneficial course of progress to both the human race and the planet itself. The expansion model still maintains its grip on consumer societies globally, and while the equilibrium model is beginning to justify itself within numerous professions, the challenges that face equilibrium development and economics will only be met when professional disciplines honestly and holistically integrate responsible doctrine into their practices. It is in this light that the profession of design has begun to embrace a change towards sustainability, and actively encourage its evolution

As agents of design for production, industrial designers have operated under the premise that the role of the design practice is to work within the system of consumer culture and to provide services to his or her client (Margolin, V.14, #2, 1998). As the movement towards sustainable development grows, this premise has led to conflict and frustration within the design community, particularly in defining and identifying design's

role in contributing to and supporting this emerging culture of sustainability. This frustration arises primarily from a general lack of direction toward the goal of sustainable design within the professional design community (Madge, V.13, #2, 1997). With the exception of a handful of critics and visionaries, designers have not been able to envision a professional practice outside of the consumer culture; most designers have been locked in the aims and arguments of their business clients, believing themselves unable to take any initiatives of their own (Margolin, V.14, #2, 1998).

Upon recognizing the role of design within the dominant economic model, and simultaneously recognizing design's responsibility to foster a culture of sustainability, a new azimuth for design practice and education becomes clear. Just as other professions are adapting to and learning new ways to practice within sustainability, so must the practice of design reexamine its role in not only consumer culture, but in the world at large. From this perspective, the importance of an evolution in design education toward responsible practice is evident. The true potential in design lies in conception and planning; this involves the initial genesis of an idea, and progresses with the successful embedding of that idea in an artifact, environment, or system. The idea that must be embedded not only in the designed artifact or environment, but also throughout professional design education, is the culture of sustainability. This culture must be genuinely infused within education, allowing young designers to grow within the contemporary perspective of sustainability. To the extent that the role of design has been to arrive at beautiful and profitable commodities, little consideration has been given in design education to the multidisciplinary knowledge that would ready designers for work

with professionals from such diverse fields as the social sciences, the natural sciences and engineering. This narrow educational exposure strengthens the view that product design (and design in general) is limited in scope to commodity generation. It privileges an awareness of consumer culture and its situations, rather than the realm of local and global problems that are being addressed by those in the culture of sustainability (Margolin, V.14, #2, 1998).

To discuss the need for a change of focus in design education, it is critical to recognize that the nature of education in design schools for the past century has been based on “skills” acquisition and training. Industrial design schools originally were situated within the confines of a fine arts program and strongly encouraged their students to take a hands-on approach in their education (Giard, V.7, #1, 1990). As industrial capacity increased through the twentieth century, industrial design was seen not only as an absolutely necessary instrument on economic expansion, but also as the antidote to potentially aesthetically bland consumer objects (Richardson, V.9, #2, 1993). The last fifty years of manufacturing technology and industrial design has seen an eclipsing of the former by the latter, in one critical way: design became about more than just meeting physical needs; the consumer's desire for objects was now a most important consideration in design. This understanding of why we choose certain things for possession (and its connection to marketing practices and research) became the driver for contemporary product design. Furthermore, the theoretical base of industrial design had expanded in proportion to that of other technological professions; given the development in areas such as materials, manufacturing processes, ergonomics and technology in

general, the knowledge base of industrial design was becoming broader and more complex (Giard, V.7, #1, 1990). As evidenced in professions across the world, knowledge has displaced skill as the primary root of innovation, prosperity and progress. While this shift is evident in the industrial world, it has yet to be fully actualized in design education and practice. It is at this point in history that design education must modify its curricula to reflect the need for artifacts and environments to connect with humans in ways that build positive and long-lived bonds between the two. If the goal of reducing consumption to sustainable levels is to be realized, then the connection between user and object must be the focus of the designer. If it is our hope to change the dominant culture of disposability, then the emotional and subjective characteristics of objects that cause users to dispose of them must be weeded from the process.

With this change in mind, the benefits of a multidisciplinary education become clear. A firm understanding of the natural and engineering sciences informs designers of the nature of biological systems. This understanding is critical to the considerations of process, materiality, disposal; and reuse. Additionally, a working knowledge of human psychological and social factors offered by the social sciences, psychology and anthropology will further inform a designer on the emotional and cultural perspective of the users of objects.

The nature of change needed within design education goes to the bedrock of the profession: anything short of a complete reexamination of how and why we design objects for human consumption will eventually be only a half-measure, and will not authentically cultivate a culture of sustainability. Through an unmodified lens of the

profession, design will continue to be part of the problem, and not part of the solution.

Given design's nascent role of ideation and conceptualization, insufficient effort to craft the education of future design will only promote the under-utilization of the field and the artifacts that it produces.

Analysis of Potential Emotional Traits

Considering the aforementioned discussion of human/object bonding, the nature of consumption and consumerism, and the role of aesthetics in design for sustainability, the designer can begin to identify the fundamental criteria that might need to be satisfied in order to cultivate positive user/object relationships. The product or object characteristics relevant to design for sustainability range from physical attributes that the product would embody, to esoteric connections that the product makes with the user's psyche throughout ownership. During this exploration, several important attributes of positive user/object relationships will be considered:

Keep It Real

Always insure that objects deliver what they promise. Authenticity plays a crucial role in nurturing of sustainable subject and object attachments; its absence drives a colossal wedge between subject and object, and what empathy may have been developed prior to this realization promptly disintegrates (Chapman, 2005, p.82).

This attention to the detail of authenticity is critical to the culture of sustainability as it is the foundation on which the values of responsible design rest. The use of materials

that imbue a sense of false, cheap or shoddy craft will speak this sentiment clearly to the users of objects that incorporate them. To represent the notion of sustainability, the materials must represent the values of sustainability.

A Mind Of Its Own

Give objects the appearance of having a mind of their own, or at least aim to simulate a subtle and random presence of free will. Engendering a degree of disobedience in products, rendering them less “yes or no”, and more “maybe” can create this situation. A light touch is required here, as excess alterity, dissonance, or conflict transforms previously subordinate objects into adolescent rogues, which in many cases rapidly fall out over favor (Chapman, 2005, p.82).

To create objects with their own sense of free will might seem to be unnecessarily difficult, but this capacity, when executed with balance and sensitivity, will cause an interaction of necessity between users and objects that eventually can turn into a positive bond. Naturally, this is a tightrope exercise, and must be performed with intense sensitivity to the nature of the object and the potential user. Seen more as a unique qualifier of worth and individuality, and less as a product of insensitive or ignorant design, this attribute has the capacity to foster an enduring attraction between user and object.

Provoke A Response

Design objects that provoke some kind of emotional response from the user. The way in which we each respond emotionally to given stimuli is what both separates and defines us as unique individuals; therefore, creating objects and experiences that provoke a distinct and clear emotional response - whatever the response may be - will engender the felt sense of individuality, self-definition and the affirmation of identity within users (Chapman, 2005, p.109).

The nature of the response to an object will in some cases be the critical bridging point between the user and object. If we react happily to an initial contact, our memory of that moment will always inform our emotional judgment of the object from that point on. Naturally, the goal is create positive responses, as negative one will defeat our goals. The ability of an object to challenge its user through discovery and revelation creates a unique opportunity for psychological bonding, and establishes an positive precedent for future interactions with the object.

Layers Of Narrative

Durable narrative experiences must embody multiple layers, allowing numerous interwoven narratives to be simultaneously cognized, and revealing, on discovery, not answers or grand finales, but deeper and more complex layers lurking within the object's semiotic make-up (Chapman, 2005, p.136).

Just as a story unfolds to draw the reader further into the plot, a well-designed object establishes and nurtures a narrative between user and object that builds over time, continually raising the level of not only commitment to but return from the object. Crucial to this narrative is the incorporation of the user as co-author and contributor to the story; objects that inherently involve the user benefit the most from the process.

Aging Gracefully

Anticipate the aging process of objects. Whether we like it or not, things get old, and it is imperative that we begin designing for desirable aging as a means to embrace their inevitable futures. This is not to say that everything should be made from wood, denim, or perhaps leather; rather, provocative design concepts must emerge that challenge our social desire for a scratch-free world, illustrating how the onset of aging could actually concentrate rather than dilute the gestalt (Chapman, 2005, p.136).

The consideration of materiality is critical in the design of sustainable objects. This materiality not only represents the values and inherent meaning behind an object, but it signifies the nature of character and aesthetics unique to that object. Designers must strive to promote a sense of understanding across consumer society that the illusion of the gloss-perfect surface is just that: an illusion. There is no place, material or surface in nature that suffers a blow to its innate worth by having scratches upon it. Rather, this work of wear actually bestows a sense of character and wisdom upon the object, indicating the mark of life experience. It is critical, however, that this mark indeed be genuine, as visual dishonesty or fakery undercuts the potential for positive bonding.

See Beyond The Physical

It is important to see beyond the physical, attending equally to the meanings that a product signifies. Essentially, consumers acquire meanings, not objects; objects simply provide a way of perceiving the meaning. Furthermore, try to gauge through scenario-building to what degree these meanings are sustainable and how they might evolve over time, if at all (Chapman, 2005, p.55).

The promotion of the culture of sustainability will require that we as designers pay close attention to the signified value and worth of objects based on more than their current trend or fashion value. The significance and relevance that these objects display will, and must originate in their core semiotic make-up, something of much greater importance than appearances alone.

Create Meaning through Connection

A meaningful association must first be perceived within an object before users may experience any arousal and subsequent emotion. Easily cognizable meanings provide the essential foundation upon which arousal and emotion are constructed. Therefore, it is helpful to consider how an object will be perceived by the user and what meanings may be associated with that initial perception (Chapman, 2005, p.109).

Similar to the previous trait, the understanding and appropriate use of meaningfulness beyond physicality will be a critical aspect of the design of sustainable objects. This component will have much to do with the establishment of aesthetic guidelines in sustainable design, since much of the notion of beauty, tactility and

sensoriality in sustainable design will originate in the inherent value and meaning of the object.

Avoid Over-programming

It is vital that a degree of ambiguity and space is embedded within a given product semantic. This means that although sufficient intuitive information may be made evident for the user to operate the product, undefined interactive space should also be made available to be explored and defined by the subject as the relationship unfolds. This undefined space also provides a kind of mirror, which reflects back the idiosyncrasies of each user, rendering each interaction unique and personal (Chapman, 2005, p.162).

The crowding of visual and meaning-based content in an object will quickly and negatively lead to the over-saturation of the user, leaving them frustrated and uninterested in the object. Critical to this is the idea that heavy ornament and excessive detail will detract from the user/object experience, initially inciting emotional satisfaction, but then not providing the same continued level of emotional stimulation. As in nature, moderation in the application of detail, and promoting a rational aesthetic beauty should be the dominant themes.

Overview

Critical in the understanding of this review of literature is the specifically mentioned aspect that design is about observations and empathic judgment. Designers attempting to effectively address design for sustainability must recognize that the process

is fraught with sensitivities and judgment calls, and since each design challenge is unique, the operator must employ the methods and techniques that best apply to the task. This is the basic reason that a “template of sustainable design” won't work. The past 150 years of object design has been the result of a template in which no consideration was made to anything but the bottom line. Little flexibility was allowed to be incorporated into the process, producing a very narrow range of potential outcomes. As a rule, a template tends to homogenize the outcome of its application. This crisis of “design and its offerings” will best be mediated by a process that, at its core level, is nimble, responsive and empathic. In this light we see that the recommendations of this literature are just that: recommendations, and not rules or procedures. It is up to the designer to combine knowledge from whichever disciplines apply to achieve the ultimate goal of positive product bonding and responsibility in creation.

CHAPTER IV

METHODOLOGY

A certain adaptability will be useful to the designer when considering this integration within the entire design process. It is generally understood that every single emotional trait that can be considered won't be appropriate for every design challenge. The judgment exercised by individual designers will be critical in determining the choice of and extent to which any emotional traits or characteristics are employed. Each design challenge is unique: context, environments, materiality, programming, use and disposal are all factors that require adaptability and flexibility on behalf of the designer. Added to this list is the requirement for designers to demonstrate an emotional awareness of and empathy for the user and the human environment.

Given the fluid nature of the design objective, a certain “flexibility of application” was the rule for this exploration. The very nature of sustainable design dictates that the designer must observe not only the characteristics of the object as they relate to emotional factors in the human/object narrative, but the methods and processes related to the manufacture of the object as well. As every designed artifact will differ in some way from the last, the designer must take full license to be free to experiment with the most effective way forward through the exercise. As stated by designers familiar with the unique nature of this topic, there is no template to apply to this process. The designer must rely on one's own life experiences, passion and emotional depth of knowledge and

common sense to arrive at a process that is reflective of the rules of design, and beneficial to the cause of promoting a culture of sustainability. This thesis is a design study, a formal exploration examining the potential use of industrial waste stream materials in value-added products.

It is important to understand the impact of typology on the design process, and its potential to thwart the energy of the designer throughout the process. For this exercise, a specific typology of furnishing or object was intentionally not chosen. Rather, some freedom was allowed in this exploration to focus on the traits themselves, and how they might be embodied in an object, without causing a restriction that might limit the designer's perception during the process based on typology. Of primary concern is the notion that establishing a typology at the beginning of the process prematurely causes the design to be labeled or "boxed-in": if one chooses to design a table (a given typology), then the designer now thinks that it must 'look' like a table, and therefore, what does a table look like? This dangerous precedent can prevent the full realization of the target emotional traits before they can be developed and promoted throughout the exploration. Invariably, there will be situations in which the designer must approach the task of object design from typology first. However, the goal of this exercise was to strengthen the process of embedding positive user/object traits within designed artifacts, and this action was best served by at least initially avoiding the potential complication and complexity associated with typology.

Critical to the successful analysis of this exercise was the documentation of the process. In order to create and gather the largest volume of visual information, a loosely

formatted method of design sketching was used to record the generative and ideation energies marshaled throughout the exercise. This method of formal exploration became a physical collection of sequential, hand-drawn journal entries, spanning a four to eight week generative period that gave the designer not only a 'workboard' of ideas, but also provided a medium of reflection throughout the generative process. The greatest benefit of this method was the sheer volume of ideas created. This collection of visual ideas served as a reference for feedback and internal, personal dialog for the designer over the course of the exercise. Additionally, a weekly review of the drawings based on the goal of trait integration provided the designer with a forum for reflection and examination of output and potential design solutions. This review was an ongoing process of personal reflection and discussion with peers and committee members.

It is important to note at this stage, specifically due to a lack of typology, that this exploration proceeded without any specific intent other than the constant consideration of the traits to be embedded, and how object aesthetics could be influenced to support this goal. Hopefully, this freedom from typology has allowed a deeper examination and understanding of the traits as they manifest themselves in an object before it is even an 'object'. The goal was to recognize the traits in their most nascent form, before they are influenced by function, role or perceived typological relevance.

Of considerable interest in this exercise was the role of aesthetics in the design of objects. Since the nature of aesthetics, and beauty in general, is relatively subjective, this represented a significant challenge to the designer. The danger in employing common aesthetic trends in this exercise is that trends, by their very definition, tend to be short-

lived, lacking any real potency and staying power. If we are to take the task of responsible design seriously, then we must attempt to make our designs attach themselves to users in positive ways, promoting longevity. Effectively, the challenge was to distill the essence of sustainability, its very value and meaning, and apply it genuinely to the object. This means that objects must fundamentally and holistically represent responsibility, restraint, equity and sensitivity throughout their materiality, function and existence.

Beginning with the generative process, the object traits were reviewed, and their potential for inclusion was considered individually. Given the subjective nature of these traits, a fair degree of latitude was allowed in the interpretation of this stage of generation. As stated before, constant reflection on the potential meaning of visual cues relating to each trait was the rule as the objects took shape. This high level of reflection and assessment per object is the only way we can ensure that we are 'paying attention' to the goal of sustainability in design.

Perhaps the most significant factor in the successful integration of positive user/object traits in product design is the designer behind the pen. As mentioned previously in the accompanying Review of Literature, the aggregate impact of life experience, skill and general social awareness of the designer is a very effective tool in the crafting of emotionally durable connections between user and object. Of equal value is the passion and excitement found in the process of exploration, discovery and revelation.

Given the importance of these aspects to the design process, it has been the ongoing focus of this exploration to reflect upon life's experiences, and to work to

combine these experiences with the capacities of art, sculpture, fabrication and material awareness. This synthesis of skills, emotions and experiences may be the most effective, and perhaps the only tools available to the designer to achieve the desired outcome.

Ideation: Concept/Generative Drawings

The process that was used to fulfill the generative, or initial ideation phase, consisted of volumes of loosely organized sketch drawing using 12 inch by 30 inch sheets of tracing paper originally from a large roll (Figure 1 containing 27 sequential images). This medium was chosen due to its inherent stability with a variety of inks and pen types without bleeding. Another key factor in using this medium is its low cost.

However, the most beneficial aspect of this medium is the nature by which the designer can use it to maintain a left-to-right sequential record of the process as it evolves. During the process, 27 sheets of this paper were filled with generative explorations and graphic/visual experiments. While matters of medium and material are decisions best made according to the designer's preferences, there is great benefit in this method simply due to the inherent record-keeping capacity of the format. Working from left to right, the designer (and anyone else who may need to be a part of the process) can easily and readily grasp the evolutionary nature of an object's path from scribble to actionable idea. This aspect is particularly useful to the designer when the time comes for reflection and direction changing. In this exploration, this built-in recording element allowed for constant review and evaluation. It was intended to help shed some light on the designer's process, as well as the way we think about and undertake the design

challenge.

As evidenced by the nature of the drawings, there was an obvious and visible “flow” to the process that at times seemed inconsistent with the goal of product design. However, this is the nature of the design process, and it has been and always will be fraught with fits and starts, epiphanies and disasters. Perhaps this will be of some use to future designers, regardless of whether or not they are designing for sustainability.

Ideation: Form and Sketch Models

The next phase of the exploration focused on the construction of several form models based on images and concepts from the generative/drawing phase. Using several different materials and tool methods, twenty-one form models were created to help visualize the three-dimensionality of the concepts. While initially helpful in establishing ideas, drawings represent only the first step in the design process. Their restriction to two-dimensionality prevents them from conveying characteristics that will only come to light when realized in form. These models made it possible to begin gauging not only the scale and stance of an object, but also the nature of contour and shape as the objects evolved.

Starting with two-inch insulation foam in sheet form, several abstract and very experimental forms were created from drawings made early on in the exploration (Figures 1 through 10). The most useful tool for shaping and deriving these models was an electric hot-wire foam cutter. Given the very hands-on nature of this tool, models were literally sculpted from foam with heat, enabling the rapid creation of visual ideas in three dimensions. These forms served as initial visual experiments in how contours unwind

across objects, and how the sculptural inclinations of the designer can influence this very immediate process throughout.

The next phase of models included several typology-specific explorations of seating and stools (Figures 11 and 12). Made from foam using the hot-wire cutter, these models also included bass wood structural elements to indicate other materials that might be used in final construction. Limited to only two models, these iterations served as a brief experiment in the consideration of seating as a final product for the exploration.

The third and final set of models created indicate the eventual direction of the work in the exploration. Beginning with planar forms originally created as abstract objects, these models highlight, as before, an investigation of the object and its contours. However, it is in this phase of model-building that the functional capacity of these objects begins to be visible (Figures 13 through 16). After several models were created with insulation foam, the decision was made to begin a more focused study of the forms in a more controllable and refined material. Using plastic modeling clay, three models were created to consider the subtle contour characteristics of the object under investigation (Figures 17 through 22). This material proved to be most effective at conveying the sculptural nature of the object, its curious asymmetry, and the contours that were the product of unique volumetric intersections.

Feedback and Review

Throughout the generative process, considerable feedback and in-progress analysis was provided by the thesis committee members. This resource had a great impact on the outcome of this exploration. The direction of the body of work, visible in the drawings, clearly shifted due to the reassessment of capabilities and the reevaluation of priorities. Input of this nature is exactly the type of “world” knowledge that a designer can accrue over time in order to be best informed when considering design for sustainability, and all of its human-interface intricacies. The benefits of “exposure” in life experience are seen by many design scholars as key factors in the forming of a broad-spectrum awareness of sustainability. This awareness is seen as critical to success in sustainable design.

The relevance of the drawing method chosen for this exploration became clear in this phase and cannot be overstated. The ability to look back through the ideation and generative process provided ample opportunity to purely see the form of the objects as they evolved (Figure 1). The nature of the drawings shows a clearly experimental process with unknown outcome. What became visible in review of the drawings is the designer's oscillation from form to form, and idea to idea. Experimentation with simple linear elements gave way to volumetric and spacial potentialities. Planar values and forms raised questions about intersections and axes of movement. Redundancy and repetition became immediately obvious, forcing the designer to either examine the repetitious line for further potential development, or consider moving in a new and unfamiliar direction. In this phase, ideas were established, dismissed, revisited, and possibly taken to their next

iteration. No idea was considered permanent or final, methods and means shifted freely, and the outcome was always nebulous and uncertain.

In undertaking the exploration of design for sustainability, the designer was constantly reminded to keep certain object traits in mind throughout the generation phase. This proved difficult, if not impossible, due to their potentially subjective influence on the process and its outcome. It was realized during this phase that some distance had to be maintained from these empirical factors in order to allow full range of the designer's aesthetic sensibilities and inclinations. These traits in fact acted as a restriction much the same way that strict observance of typology can change the process and its outcome. Ultimately, the process was most influenced and guided by the designer's personal aesthetics and expressive capacities. While feedback and reflection regarding positive user/object relationship traits was key to the desired result, the exploration relied heavily on the designer's personal interpretation of the material and its potential. Through this interpretation, the designer was able and encouraged to consider multiple visual outcomes, and to let these notions take their course through the drawing and modeling phases.

Final Selection

It was at this point that the decision was made to consider the final objective as functional sculpture, and not necessarily a “piece of furniture”. This decision ultimately provided the greatest freedom from typology, as well as the designer's preconceived notions regarding the aesthetics and form of furniture. This foray into sculptural forms

and qualities yielded a much wider sample of possible solutions, allowing the consideration of multi-mode objects, as well as objects of minimal functionality.

Appearing more as sculpture, the final form chosen for fabrication was an attempt to move away from the “box” of furniture that had been the direction early on in the exploration (Figure 22). Its mass and scale became more significant when a material sample was produced to assess feasibility of fabrication. It became obvious after considering the material sample that this object would present unique challenges in fabrication, and would require a different material assembly process.

Materiality: Origin and Significance

The material chosen for this exploration is a waste product of the High Point, North Carolina-based furniture industry. Specifically, the material is birch hardwood plywood made in the Baltic region of Russia. Known for its exceptional strength and available in several different grades, it is a high-value material that offers both durability and beauty. Used at the High Point-based furniture company primarily for internal furniture components, this plywood is commonly cut and shaped into parts using a Computer-Numeric-Controlled (CNC) wood-cutting router system. While these systems are programmed to efficiently produce the highest number of parts per sheet of plywood (a CNC programming feature called “nesting”), there is and always will be some amount of material that remains unusable to the company. The cost of this waste is merely factored in to the bottom line for the production of each piece of furniture.

However, as efficient as this process is at eliminating waste, it has been noticed that the waste of this process is still useful to another process of production. Granted, while the plywood waste is not used in the same way that the furniture company uses it, the process has yielded interesting results. By changing the plywood's orientation and gluing smaller pieces of waste plywood face to face, a slab is formed, creating a very unique and visually stimulating surface and material (Figures 24 and 25). It has been noted in earlier explorations that three-dimensional forms fabricated with this material take on a distinctive visual persona, attributable to the strata of the plywood's layers. These strata call specific attention to the undulation and varied topography of the object's form, providing an immediate and innate understanding of the changes in the object's surface from one region to the next. This material conveys a message about the surface of the object: that which is visible on the surface is not a veneer, but rather a continuation of the true and same material throughout the form. The object's contours can be followed, by the strata, from one side of the object, around its perimeter, and back to the point of origin. This sense of volumetric continuation is apparent through the central mass of the form as well, heightening the viewer's understanding of the object's solidity and being. These strata provides a new perspective on the form of the object, enabling perhaps a different, if not new opportunity for user/ object connection.

The motivation for using this material is actually twofold. First, it is a high quality material that would normally be outside the realm of affordability for this type of exploration. As it is available for free from the aforementioned furniture company as trash to be taken from a dumpster, it represents a perfect opportunity to experiment with

ways to “re-realize” industrial process waste as a potentially value-added material. Second, it is a prime material that is being thrown away everyday by the dumpster-full. The re-evaluation of industrial waste streams for use in value-added products should be a point of interest and research for designers seeking to contribute to design for sustainability. While all companies will naturally seek to eliminate any waste from the production process, there will inevitably be waste generated somewhere along the line. While various forms of production yield waste that may be of little or no use, this particular industry has, and its availability is the primary motivation for using it.

Fabrication

Given the nature of the raw material used in this exploration, a significant amount of material processing was needed to bring the material into a useful form. Starting from its raw form as sheets of plywood with various parts and patterns cut out, the material was pulled directly from the dumpster in High Point, North Carolina and transported to the wood shop at the Gateway University Research Park in Greensboro, North Carolina. At the school woodshop the material is sorted roughly based on its size and thickness. In this particular construction method, the material is most often used to create slab and planar forms, allowing the highest yield per volume of waste retrieved. These planar forms are more easily constructed with the waste due to the thin strips of material that often remain after the plywood sheets are processed on the CNC routers in High Point. Depending on the size and shape of the piece to be built, a portion of this material is often unusable, due to this characteristic of CNC processing. This was the situation with this

particular product, as the object required not only thin strips of plywood for its planar surface, but also material of larger surface area to create the lower support structures of the object.

After sorting the material to general thicknesses ($1/2$, $3/4$ and 1 inch), the process of layout began. Using the clay form model as a reference, the entire plan view of the object was drawn full-size on a 4'x8' sheet of MDF fitted on a work table. This view of the object allowed the designer to see the exact location of the support structures, a view needed to ensure that material was being applied to the correct areas. From this drawing, the designer then began cutting most of the material into two-inch strips for vertical, side-by-side lamination, saving the larger pieces for the support structures. One inherent difficulty with this process is the inconsistency of thickness with the material. Made to a certain tolerance, it is guaranteed by the manufacturer to be, for example, $3/4$ " thick, give or take several thousandths of an inch. While small, these tolerance differences per sheet can make gluing together several different pieces exceedingly difficult. To counter this setback, each piece to be glued up must be sized and matched in relation to the pieces that will sit in line with it. This effectively turns the process into a puzzle where the designer has to customize each piece to fit.

Due to this particular nuance of assembly, the actual fabrication and glue-up process progressed more slowly than previous planar objects that lacked large contour changes. Typically, the materials are cut and laid down, in the order of assembly, on a series of pipe clamps used to maintain alignment during drying. This method is the best way to keep the material as flat as possible, which speeds the sanding and finishing

process. On this project, since a much-greater-than-usual quantity of scrap was used to make up the form of the piece, its shape required a much more creative clamping method throughout (Figures 23 through 25). The piece was built in stages, allowing each section of “slab” to dry before being handled; this made gluing together each section much easier, as the parts were then less able to move and “drift” under the immense force created by the clamps.

After the glue-up was completed, a pair of hard maple ribs were inserted and glued into 1-inch routed grooves on the underside of the piece (Figure 26). The purpose of these ribs was to prevent any lateral deflection and bowing that might occur in the piece due to expansion and contraction during temperature and humidity changes. The ribs were installed perpendicular to the laminate layers in order to prevent or slow any lengthwise splitting at the piece's center, away from the inherent mass, and therefore strength, of the support structures at each end. The entire wooden blank was left in the clamps for three days to allow sufficient drying before starting the shaping process.

The shaping process consisted of material removal using a variety of tools. Initially, aggressive tools were used to remove the mass. This was most easily done with a circular saw and reciprocating saw fitted with a demolition-grade blade (Figures 29 through 31). Removing large chunks of the basic block to begin revealing the rough outline, the saw saved hours of time when compared to other methods. After removing everything that the saw could safely do, a unique tool was used to begin the sculptural process of revealing the form of the object and its structures. The designer used a standard angle grinder fitted with a specialty cutting blade that had six chainsaw teeth

stamped into it (Figure 26). Without this tool, the entire process would have taken exponentially longer. It allowed the rapid removal of material in certain areas, while having the capacity of subtle and gentle operations where only fine shaving and shaping was needed. The majority of the shaping was done with this tool, and it was recognized that its learning curve is fairly flat. However, it must be noted that this tool is extremely dangerous, much like a chain saw, and caution must be exercised at all times when using it.

With the basic form of the object revealed through cutting tools, the process moved forward using high-speed wood sanding equipment. For this step, the designer used a standard angle grinder fitted with a ferrous metal-specific aluminum oxide 36-grit sanding disc on a rubber backing pad. This was the first step in the process where the actual form could be seen. Using a 4' level and straight edge, the top and bottom surfaces of the planar form were brought to nearly flat and even. After this, a belt sander with multiple 40- and 80-grit aluminum oxide sanding belts was used to begin bringing the final form into clear focus. After the 80-grit belts, the designer then changed tools and began the finish sanding with a dual-action palm sander, beginning with 80, then 120, 180, 220, 240, and then finally 340-grit abrasives. This sequence of abrasive use is critical to saving the most time and achieving a polished stone-like finish (Figure 32 through 34). Upon final sanding, two coats of a low-VOC natural oil finish was applied, first through soaking, then through burnishing with worn high-grit (400-800 grit) sandpaper to bring about a low satin finish that felt smooth and clean to the touch (Figures 35 and 36). The surface was intentionally not brought to a high or even medium

gloss finish, as these finishes not only highlight surface imperfections, but also reflect miniscule wear and abrasions more immediately (Figure 38).

CHAPTER V

CONCLUSION

Object Characteristics

The final fabrication yielded a unique sculptural object. As previously mentioned, the methods for fabrication had to be altered from the typical process used to build with this specific material. This adaptation of process provided the designer with a greater awareness of the material, and the steps to be taken to master it. Concerning the primary goal of establishing a positive user/object connection, four individual characteristics or traits of design for sustainability were analyzed for their potential application to this object. Below is the discussion of the attempt at this integration.

Keep It Real

Throughout this exploration, the material chosen has powerfully communicated its own sense of authenticity and reality. This is a material of largely natural origins, and the process employs a straightforward and simple technique of fabrication and joinery. Nowhere in this object or its process is there any attempt to represent methods or materials as something they are not. The connection of the user to the topographical form of the object is encouraged at every step through the winding and exploratory nature of the strata as it moves across the object's surface (Figures 41 through 43). The viewer literally uses the strata to “discover” the object’s intricate curves and sweeping arcs.

Additionally, the laminate strata have the unique capacity to highlight the object's sculptural qualities (Figure 43). This effect enhances the visual comprehension of not only its form, but also its materiality and sensoriality. With this exceptional material, the object's subtle and individual contour can be conveyed without frill, decoration or excessive detail. This characteristic is a powerful tool in communicating the authenticity and reality of the form and its material.

A Mind Of Its Own

The sculptural nature of this piece allowed for an "experimentation" in gravity. The shifting and changing of forms in the design process prompted the reconsideration of the bare minimums of balance and weight distribution needed to be technically sufficient as a stable object. A strong and intentional contrast was struck between the balanced symmetry of the object's surface (a rectangular, planar form of constant thickness) and the asymmetrical and incongruent intersections of the circular forms that comprise the object's support structures (Figures 37 and 38). The motivation for this was to cause further consideration, inquiry and perhaps even doubt regarding the stability of the form. This gently aberrant "misbehavior" is intended to draw the user into a narrative with the object, forcing it to show up on the user's radar, and requiring subsequent approval or disapproval.

Aging Gracefully

The material for this piece was chosen for several reasons, including cost and availability, workability, and aesthetic satisfaction. Yet one of the most fortunate intrinsic values of this material (at least in this application) is its capacity to age gracefully. Objects designed for sustainability must be prepared to endure wear and tear, enabling repair at the appropriate time, or thus be designed to be reclaimed or recycled. This wear, over time, builds around the object a certain aura, unique to that object, that encapsulates the history of ownership and the character of the life that the owner and object have shared. This history and character is a key component in positive user/object connections. In the same way that aged and weathered hardwood floors indicate the character of a house's inhabitants, the material in this piece provides a durable tablet for recording the scratches and scrapes that will inevitably occur over the life of ownership (Figures 40, 41 and 43). These marks are the signifiers of time's passage in one's existence, and instrumental in helping the object present the personality of its owner. Like a favorite pair of jeans, the table wears the story of its owner on its skin, promoting real ownership.

Create Connections with Sustainability

This is perhaps the best way to describe the energy behind embedding or entwining the piece's materiality roots with the defining essence of design for sustainability. It is assumed that users who respects and observes the tenets of responsibility and sustainability will naturally be attracted to the genuine efforts of others who share those convictions. It is this attraction that lays the foundation for a positive

relationship between the future user and an object that has been fabricated as this one has. A discriminating, aware and informed buyer will make it their responsibility to learn the origin of the materials and process before acquiring an object. This very process will be the strengthening buttress in the wall of positive relations when a user owns such an object. This connection (regarding origin and intent) is the emotional device that prompts a user to keep and maintain an object of this nature. This sense of meaning, the purpose behind acquiring object of this nature (as opposed to objects not sustainably designed), will ultimately be the strongest link between user and object, serving as the *raison d'etre* for responsible living.

User/Object Relationship

Designers have found valuable tools within the expressive sensibilities of art and sculpture for the integration of the traits most likely able to promote positive user/object relationships. While the subconscious connections between humans and the art they create may never be fully understood, the capacity for art to reflect human expression, and thereby signify it, must not be lost on the designer. This resonance of humanity in the artistic form is the precursor for the understanding of art and object alike; it is the nascent character of that which is created by the human, projecting the spark of conscience in three-dimensionality. However, the ability of designers to successfully convey the human expression and understanding through designed artifacts is contingent upon that designer's knowledge and awareness of humanity writ large. This most likely means that in order to competently integrate positive user/object traits in designed objects, designers

themselves must intrinsically understand sustainability. Short of living holistically within this lifestyle, this awareness might best be delivered through an interdisciplinary design education that discusses, at least topically, the subjects of sociology and social equity, anthropology, ethics and moral issues, as well as the more traditional design subjects including studio and liberal arts, architecture, ergonomics and design for life, and materials and resource awareness.

The relevance of this interdisciplinary approach to design education is that it will hopefully produce a well-informed designer. Only through this awareness will designers acknowledge the importance of this responsibility, and adjust their professional design output according to these realities. It is at this point that sustainability, or perhaps more appropriately, responsibility will be the standard operating procedure for this century's best and brightest designers. When this challenge is fully taken to task, responsible product design will become a reality, and perhaps even commonplace.

REFERENCES

- Walker, S. (1995) Product Aesthetics and Surface. *MIT Design Issues*, Vol. 11, No. 3, pp. 15-27. Cambridge; Massachusetts Institute of Technology Press
- Margolin, V. (1998) Design for a Sustainable World. *MIT Design Issues*, Vol. 14, No. 2, pp. 83-92. Cambridge; Massachusetts Institute of Technology Press
- Walker, S. (2006) *Sustainability By Design*. London; Earthscan Publishing
- Chapman, J. (2005) *Emotionally Durable Design*. London; Earthscan Publishing
- Madge, P. (1997) Ecological Design: A New Critique. *MIT Design Issues*, Vol. 13, No. 2, pp. 44-54. Cambridge; Massachusetts Institute of Technology Press
- Richardson, A. (1993) The Death Of The Designer. *MIT Design Issues*, Vol. 9, No. 2, pp. 34-43. Cambridge; Massachusetts Institute of Technology Press
- Wildhagen, F. (1990) The Challenge of the Green. *MIT Design Issues*, Vol. 11, No. 3, pp.28-32. Cambridge; Massachusetts Institute of Technology Press
- Walker, S. (2000) How The Other Half Lives: Product Design, Sustainability, and the Human Spirit. *MIT Design Issues*, Vol. 16, No. 1, pp. 52-58. Cambridge; Massachusetts Institute of Technology Press
- Margolin, V. (2002) The Politics of the Artificial. *The Politics of the Artificial*, 107-123. Cambridge; Massachusetts Institute of Technology Press
- McCoy, K. (1990) Professional Design education: An Opinion and a Proposal. *MIT Design Issues*, Vol. 7, No. 1, pp. 20-22. Cambridge; Massachusetts Institute of Technology Press
- Giard, J. (1990) Design Education In Crisis: The Transition From Skills To Knowledge. *MIT Design Issues*, Vol. 7, No. 1, pp. 23-28. Cambridge; Massachusetts Institute of Technology Press

Salmon, M., Gritzer, G. (1992) Parallel Content: Social Sciences and the Design Curriculum. 1. *MIT Design Issues*, Vol. 9, No. 1, pp. 78-85. Cambridge; Massachusetts Institute of Technology Press

Buchanan, R. (1992) Wicked Problem in Design Thinking. *MIT Design Issues*, Vol. 8, No. 2, pp. 5-21. Cambridge; Massachusetts Institute of Technology Press

Ryan, D. (1997) Enzo Mari and the Design Process. *MIT Design Issues*, Vol. 13, No. 3, pp. 29-36. Cambridge; Massachusetts Institute of Technology Press

Jonas, W. (2001) A Scenario For Design. *MIT Design Issues*, Vol. 17, No. 2, pp. 20-23. Cambridge; Massachusetts Institute of Technology Press

Findeli, A. (1994) Ethics, Aesthetics and Design. *MIT Design Issues*, Vol. 10, No. 2, pp. 24-28. Cambridge; Massachusetts Institute of Technology Press

Pantaar, M. (2000). Consumption as Work, Play and Art: Representation of the Consumer in Future Scenarios. *MIT Design Issues*, Vol. 16, No. 3, pp. 3-18. Cambridge; Massachusetts Institute of Technology Press

Brekke, K., Howarth, R. (2006) Two Economic Models Of Why Enough Will Never Be Enough. *Sustainable Consumption*, ch. 17, pp. 249-262. London; Earthscan Publishing

McCracken, G. (1990) The Evocative Power of Things: Consumer Goods and the Preservation of Hopes and Ideals. *Sustainable Consumption*, ch. 18, pp. 263-277. London; Earthscan Publishing

Lovin, H., Lovin, A., Hawken, P. (1999) *Natural Capitalism: Creating The Next Industrial Revolution*. Back Bay Books.

McDonough, W., Braungart, M. (2002) *Cradle to Cradle: Remaking The Way We Make Things*. North Point Press.

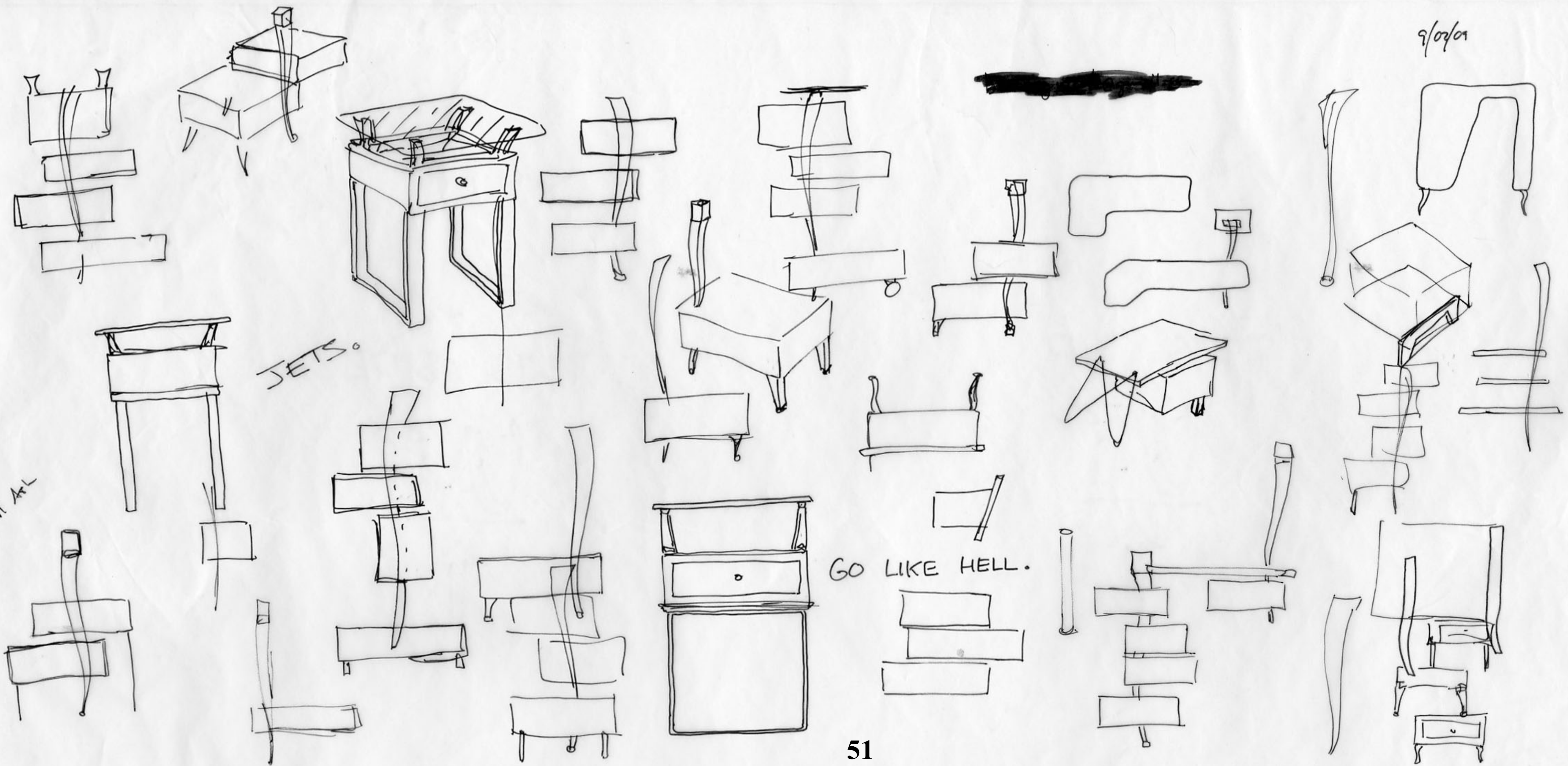
Whitely, N. (1986). Pop, Consumerism and the Design Shift. *MIT Design Issues*, Vol. 2, No. 2, pp. 46-51. Cambridge; Massachusetts Institute of Technology Press

APPENDIX A: FIGURES

FIGURES: GENERATIVE PHASE DRAWINGS

Figure 1: Generative Phase Drawings (figure 1 includes 27 drawings)

9/02/01



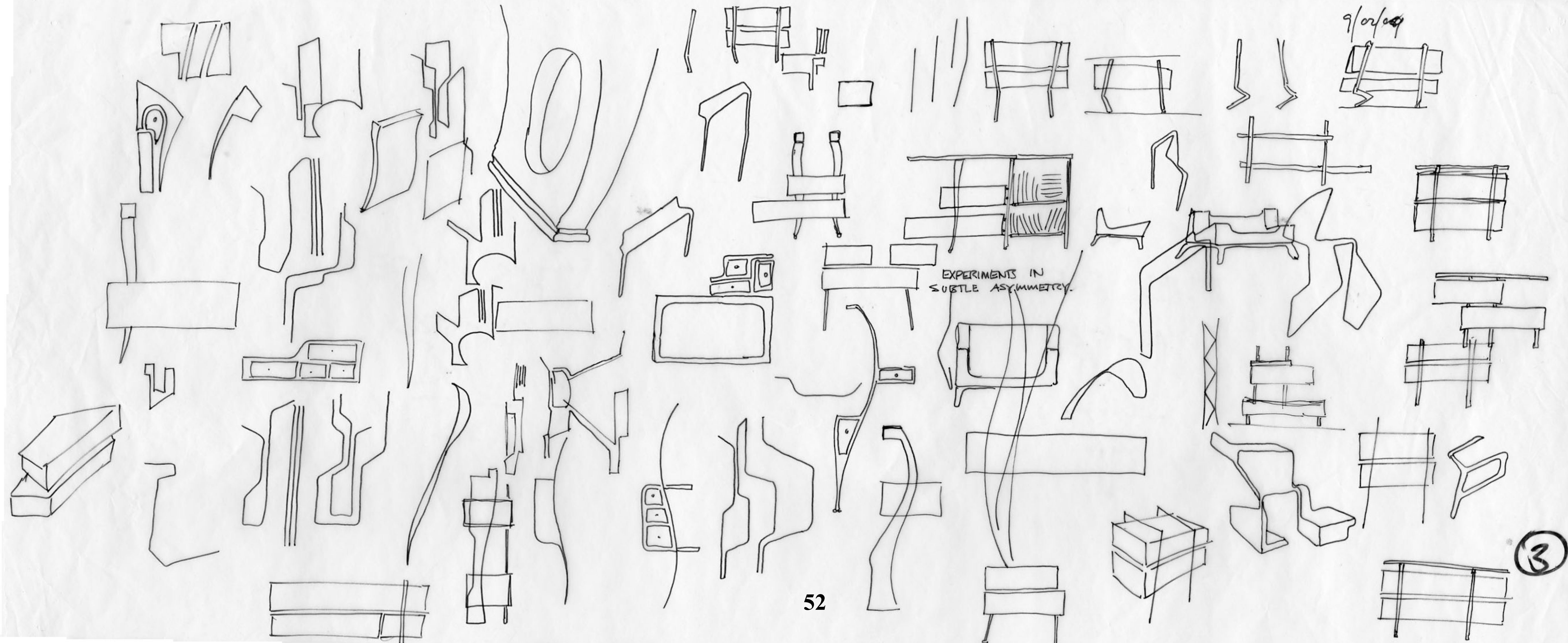
JETS.

Edward A.L

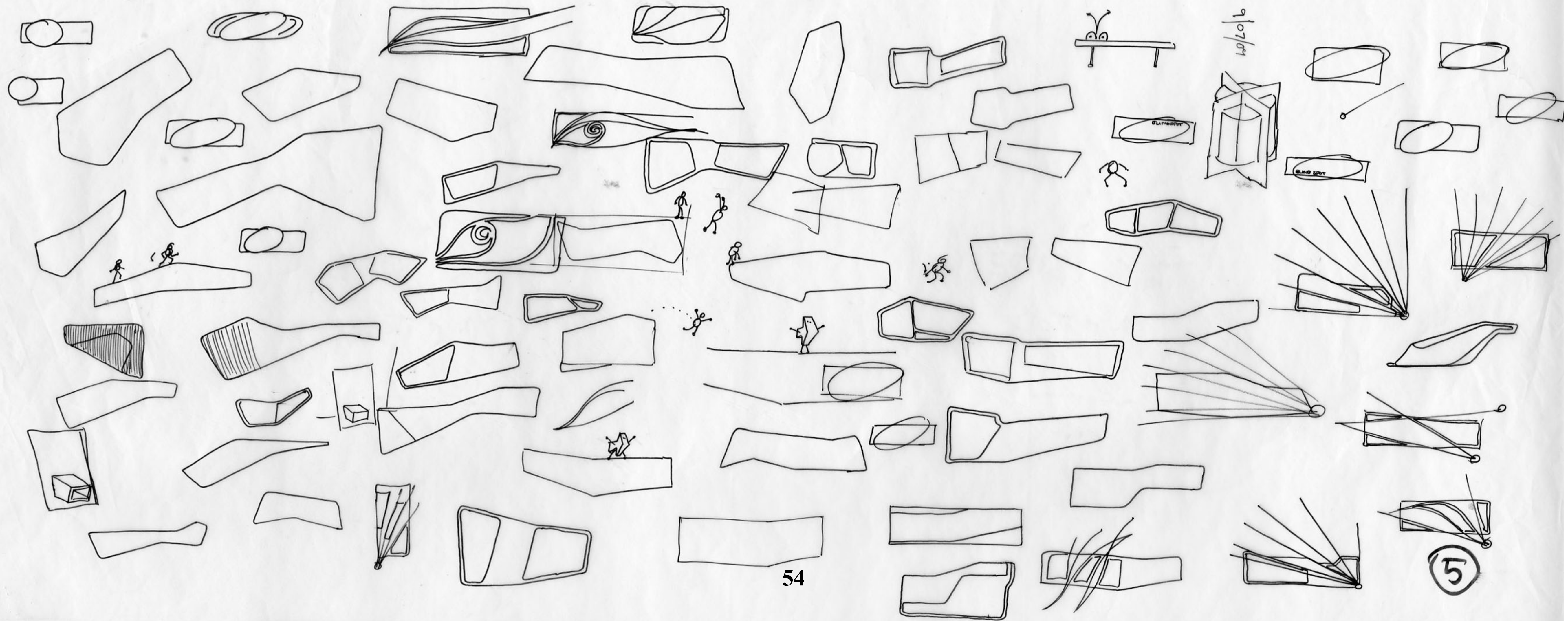
GO LIKE HELL.

2

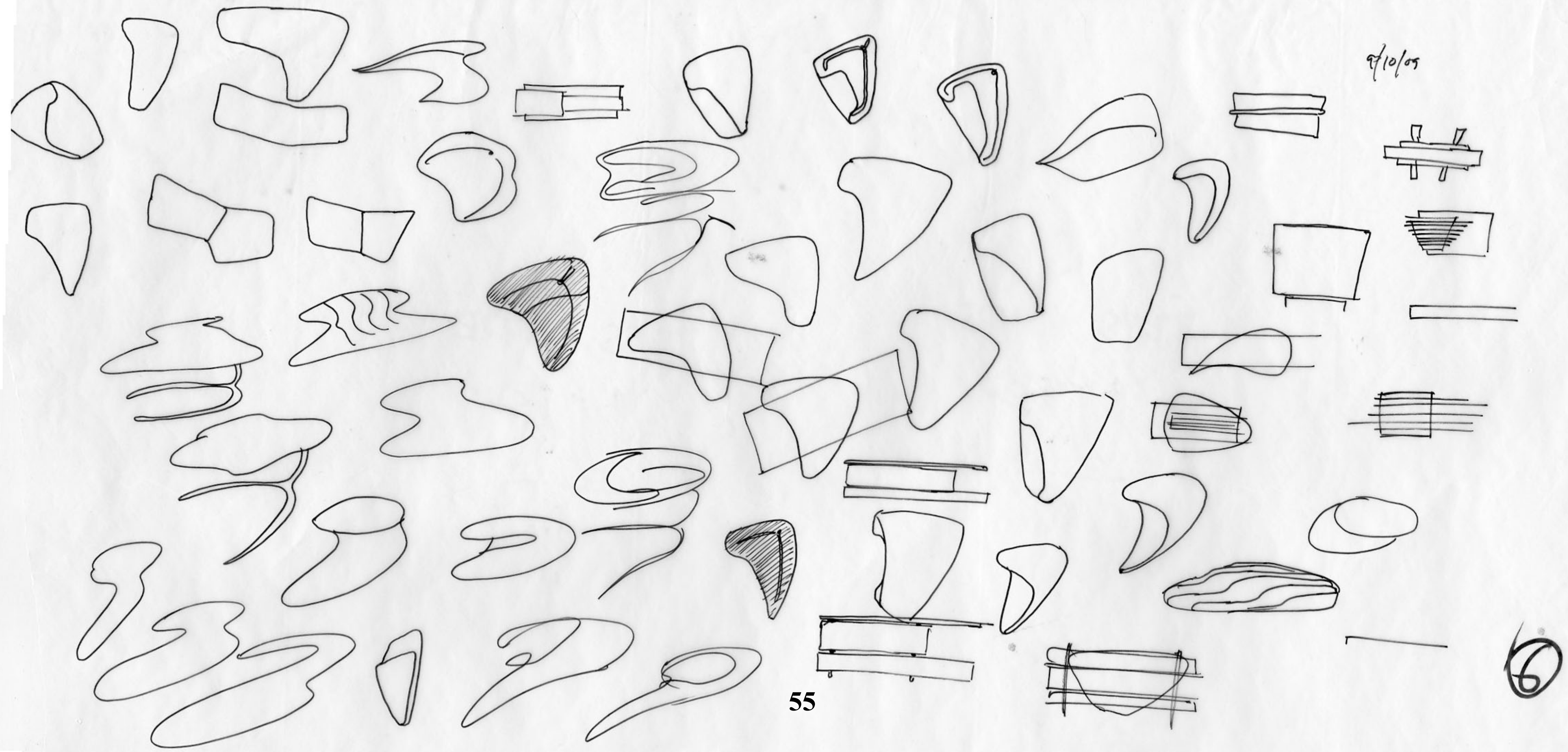
9/02/09

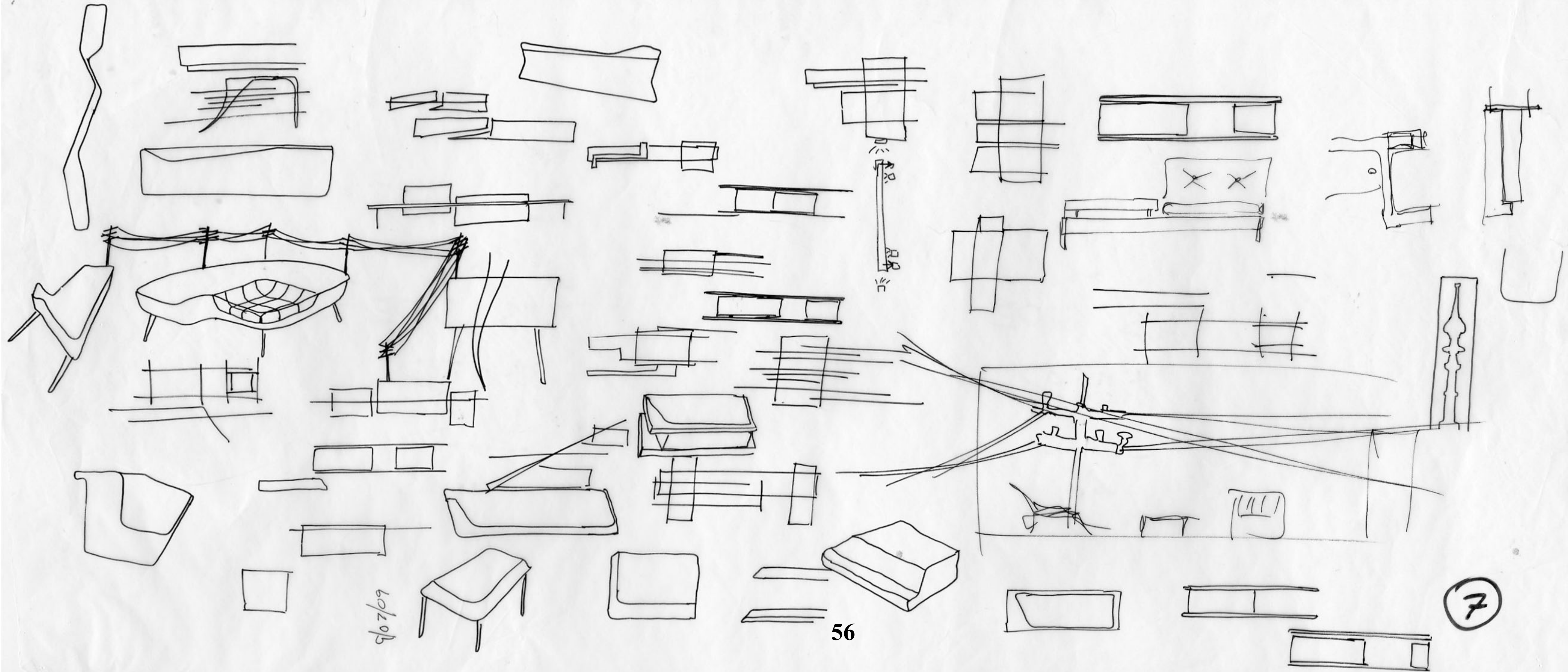


EXPERIMENTS IN
SUBTLE ASYMMETRY.



2/10/05





9/07/09

56

7

2/11/0

DJ GRABCAKES

PITCH & HEIGHT: $10\frac{7}{8} : 13$

A
25°
Back angle

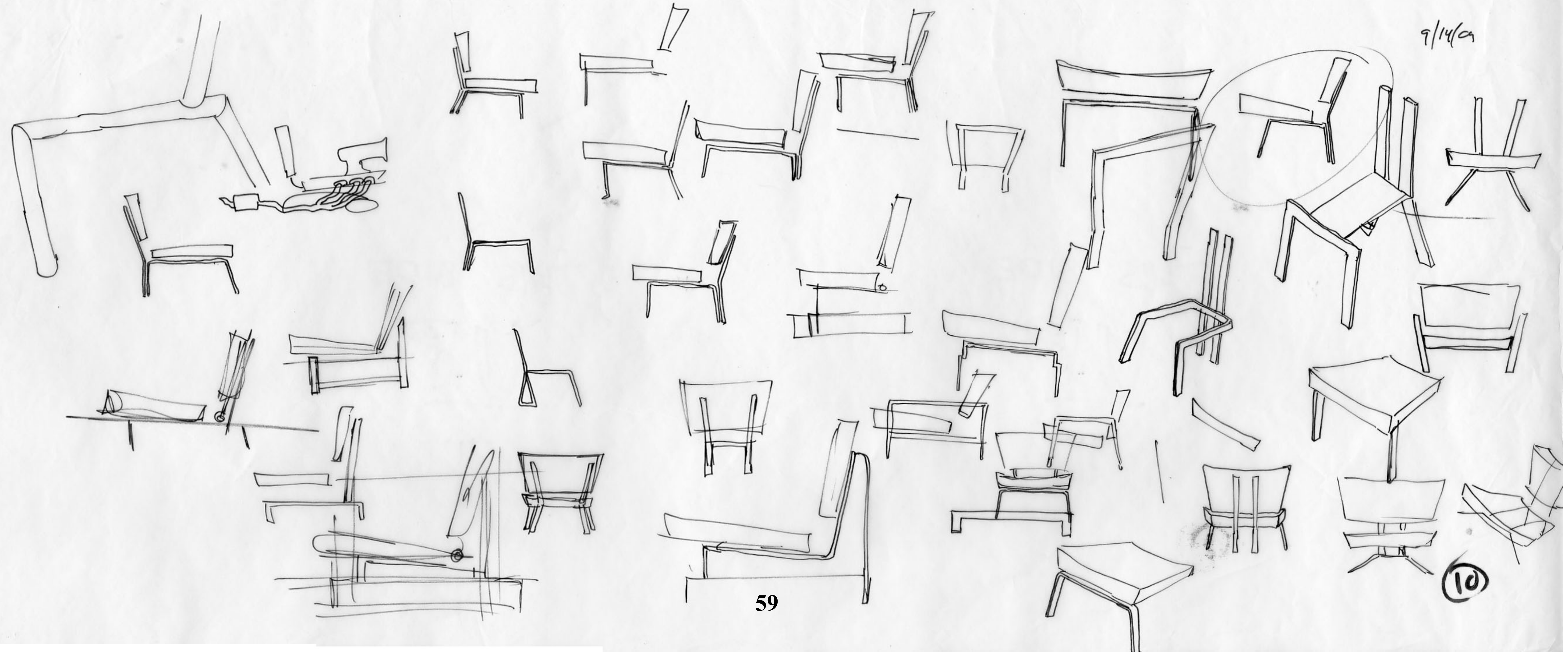


Just a bit of
misbehavior... a slight
offset, a notion of imbalance.
Will it tip? Will it behave?

a/m/c

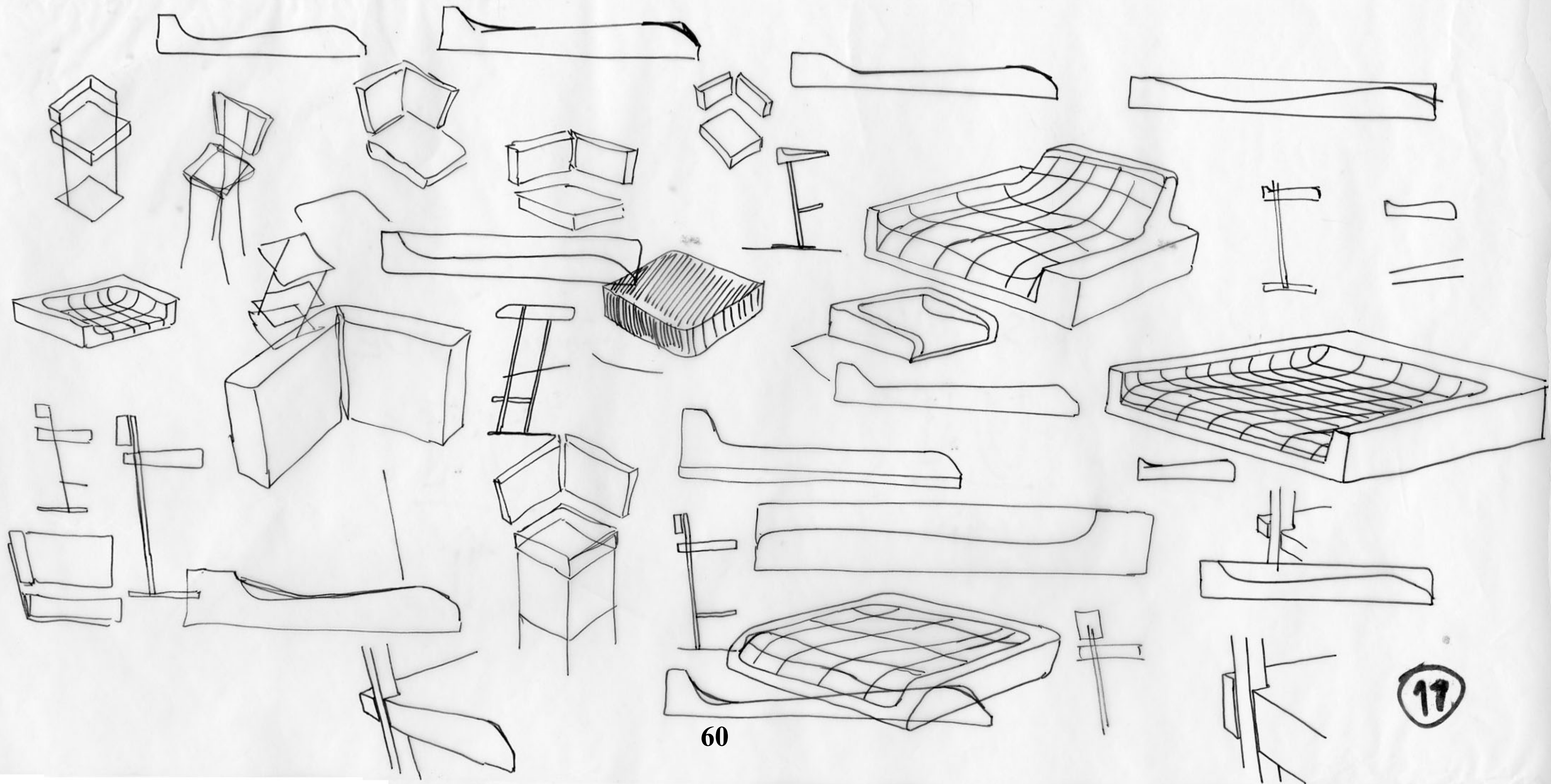


9/14/09



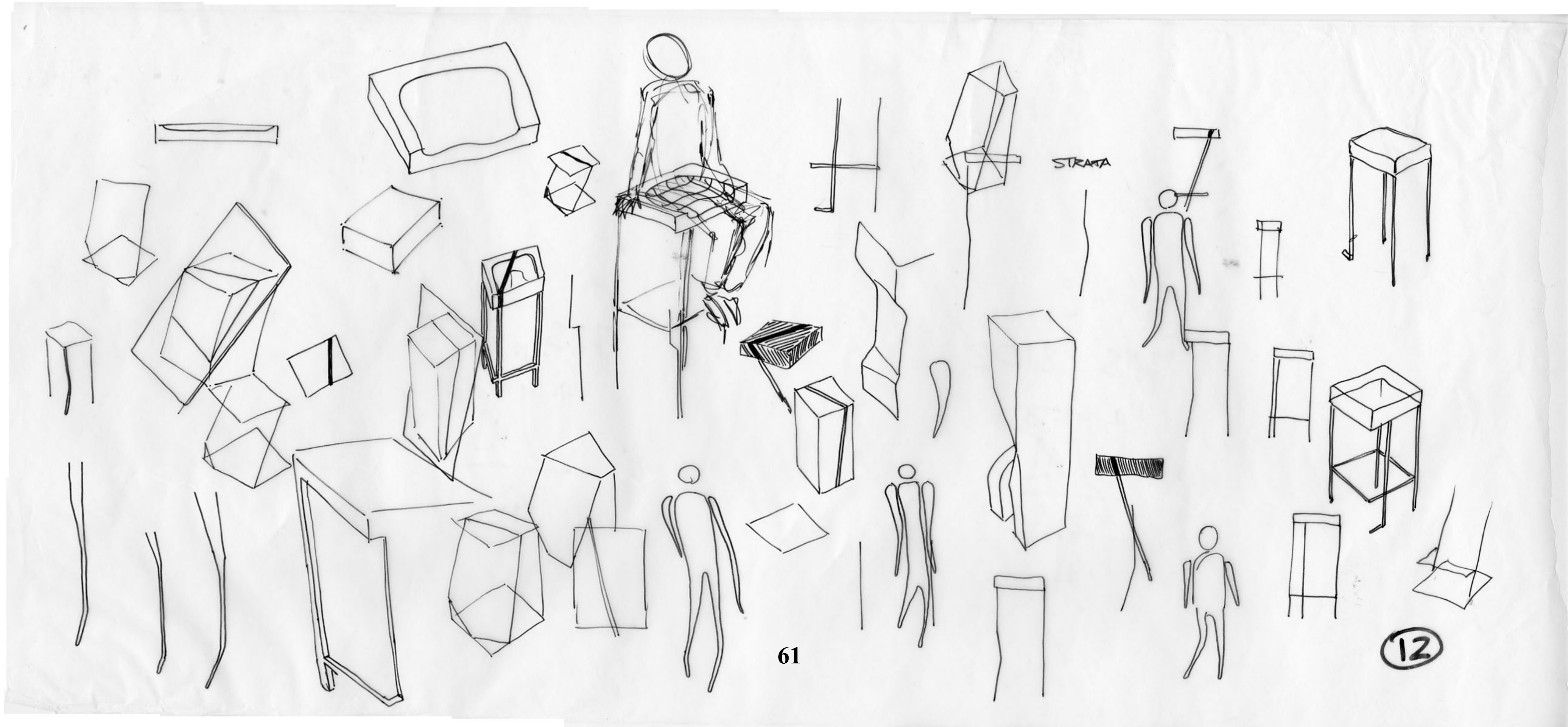
59

10



60

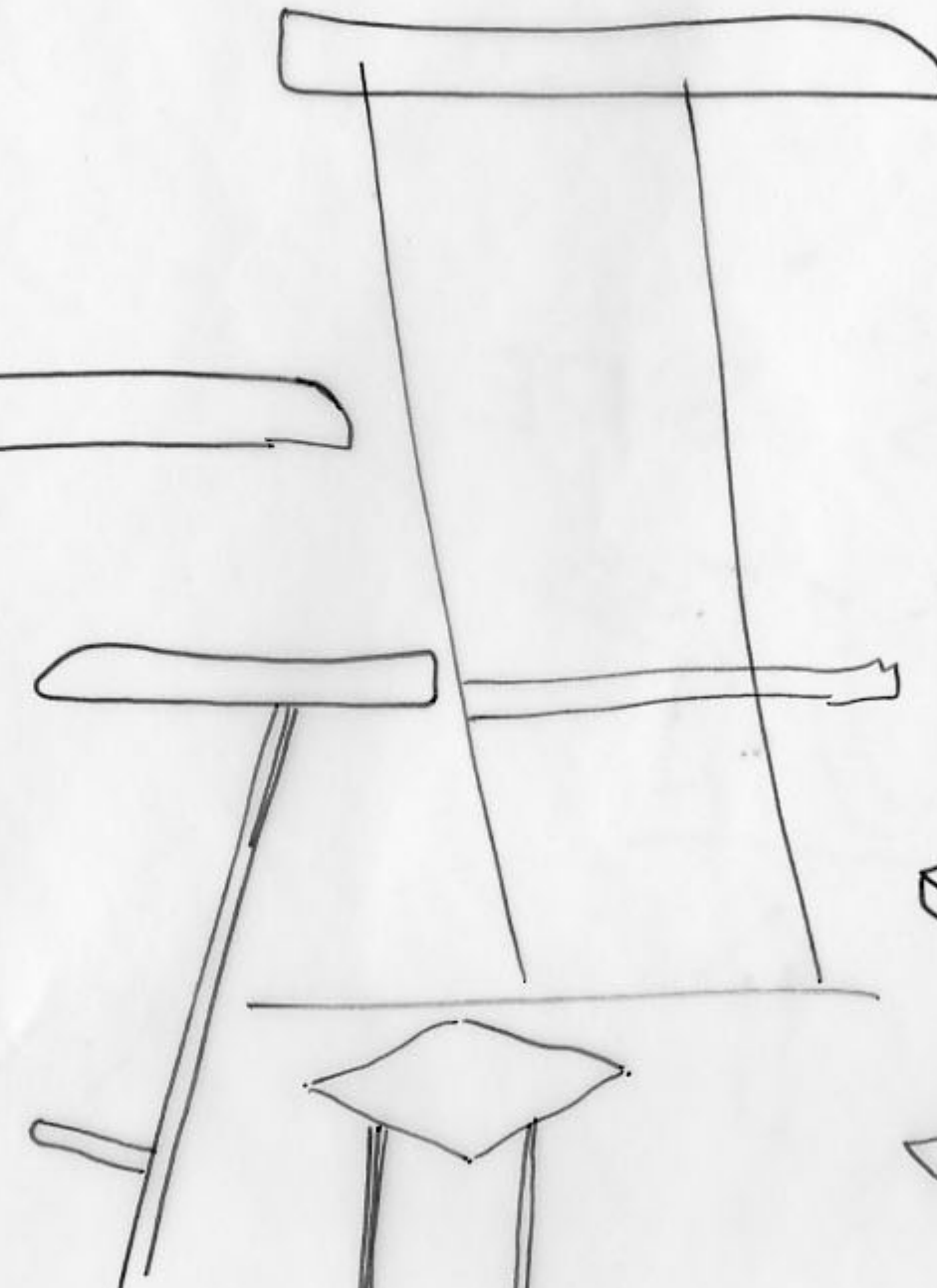
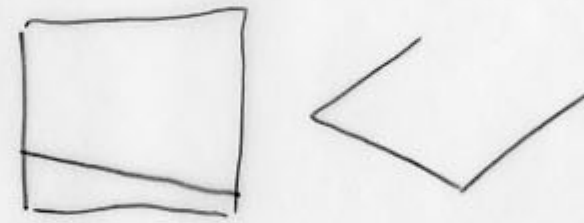
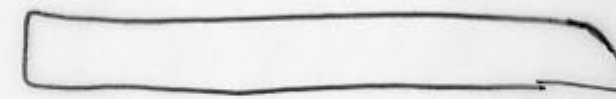
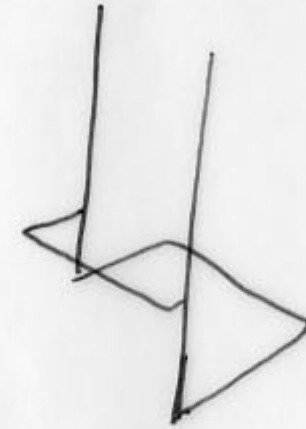
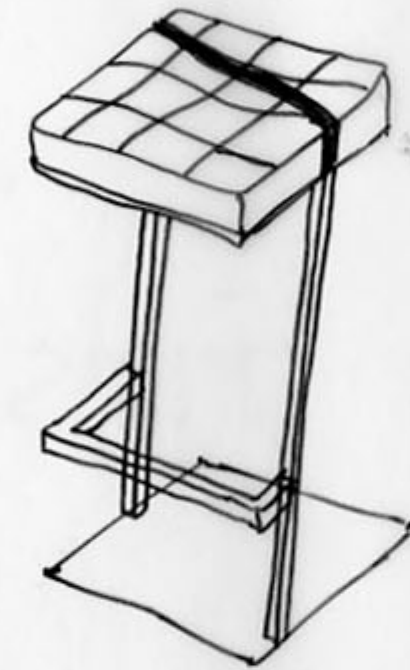
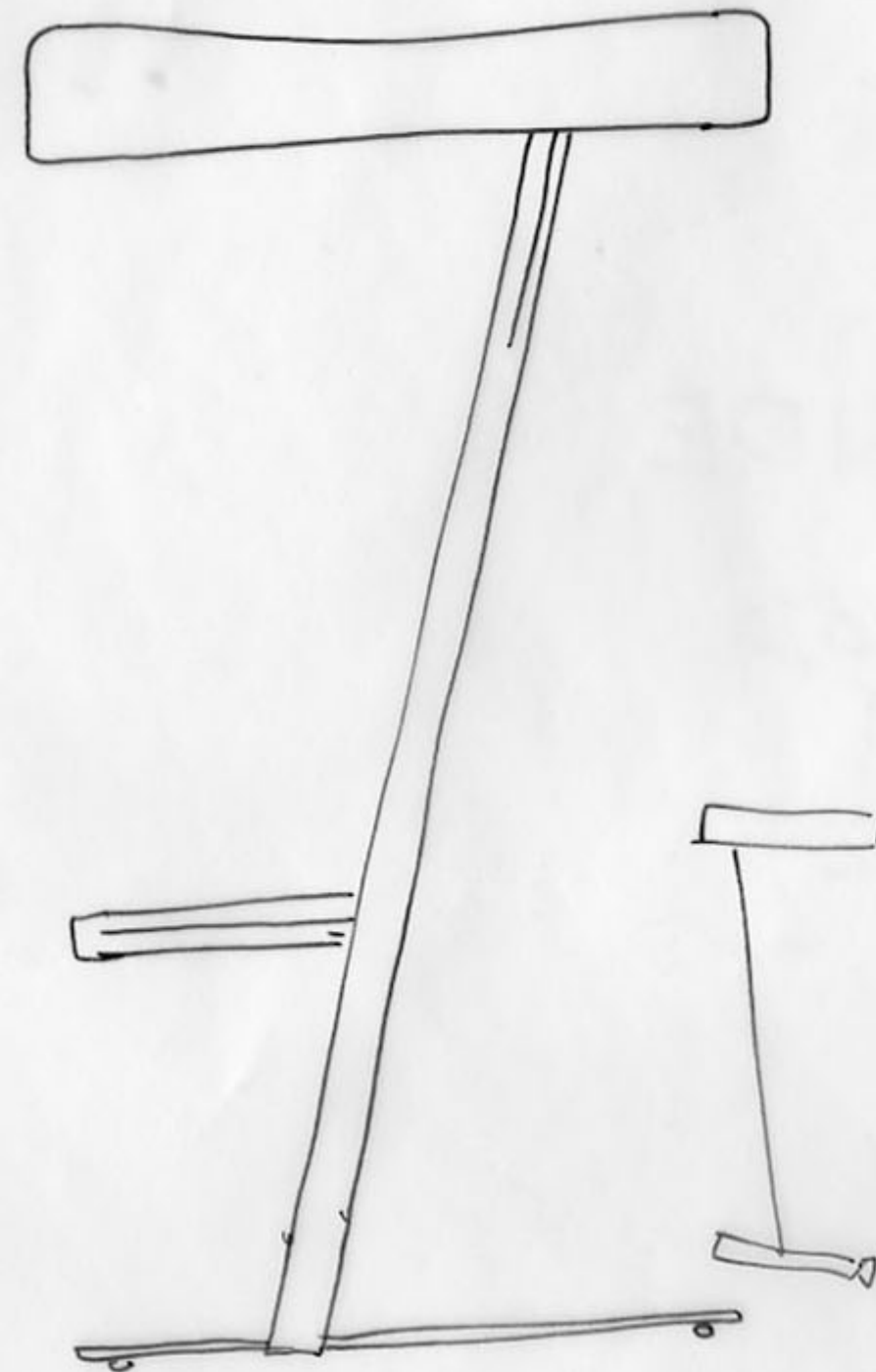
17



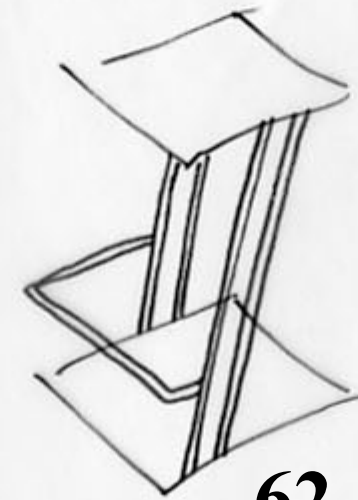
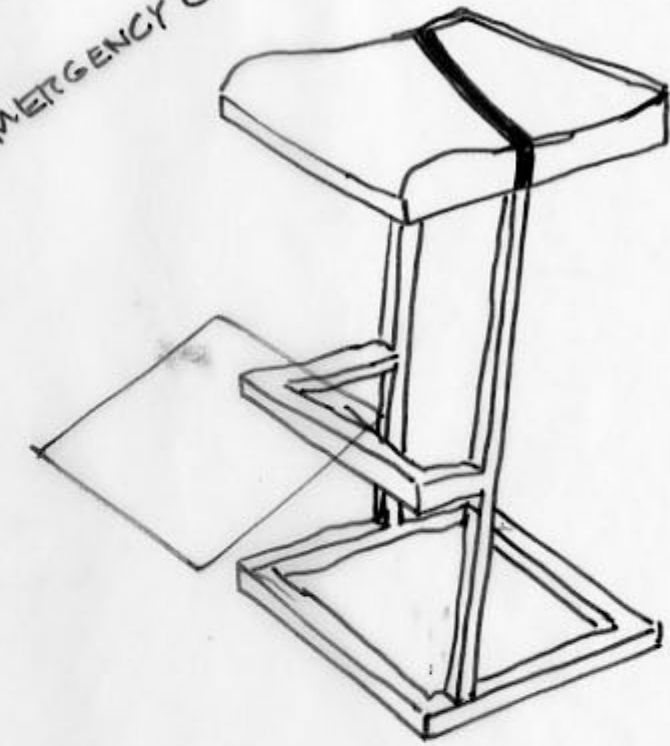
STRATA

61

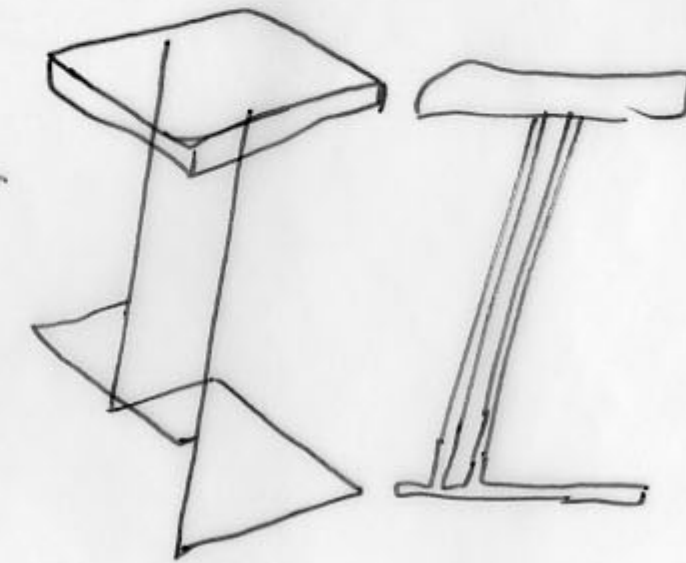
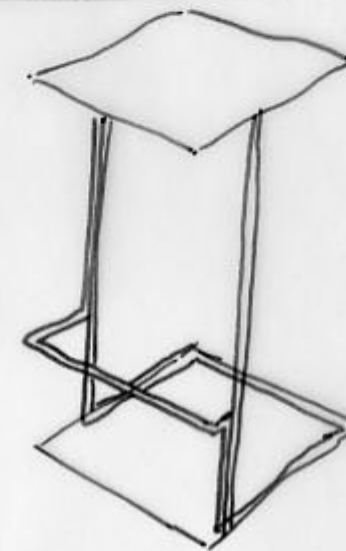
12



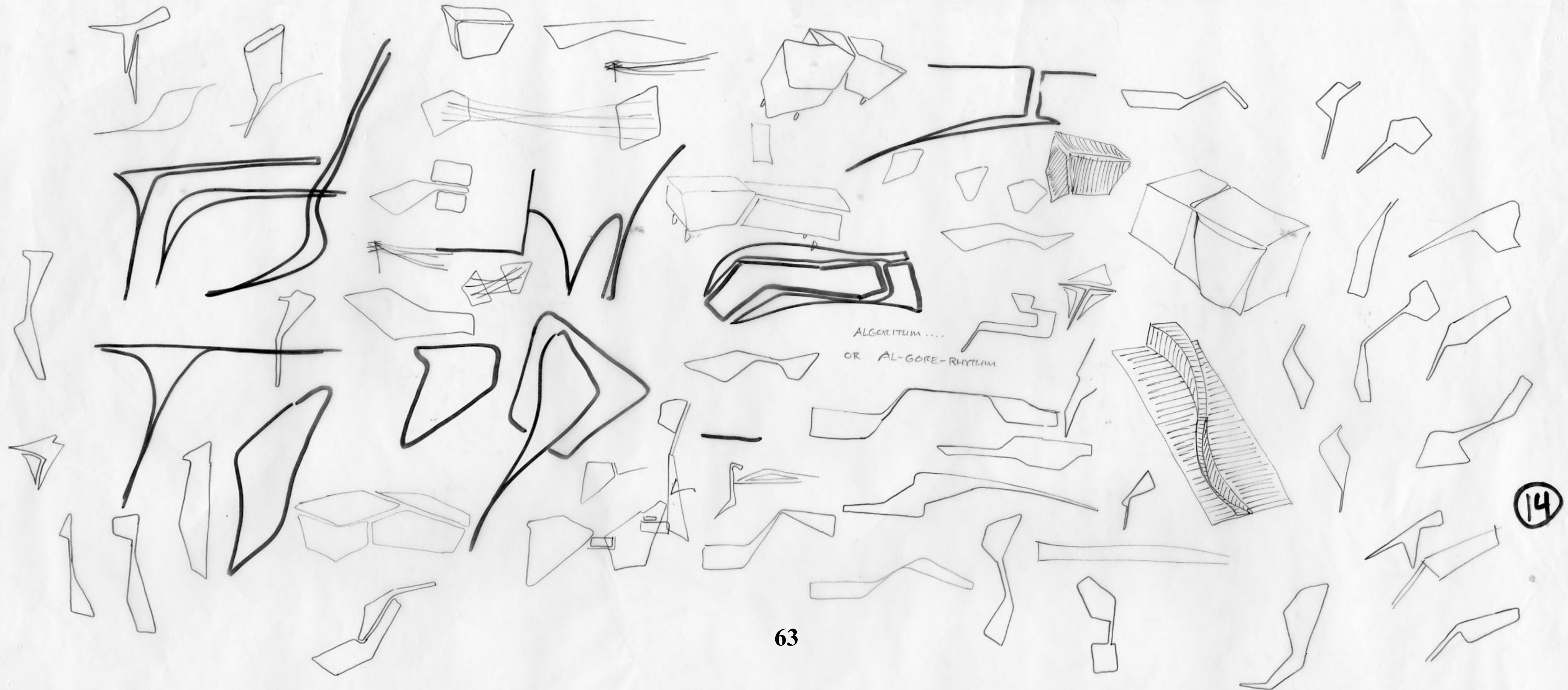
EMERGENCY CHOCOLATE



62

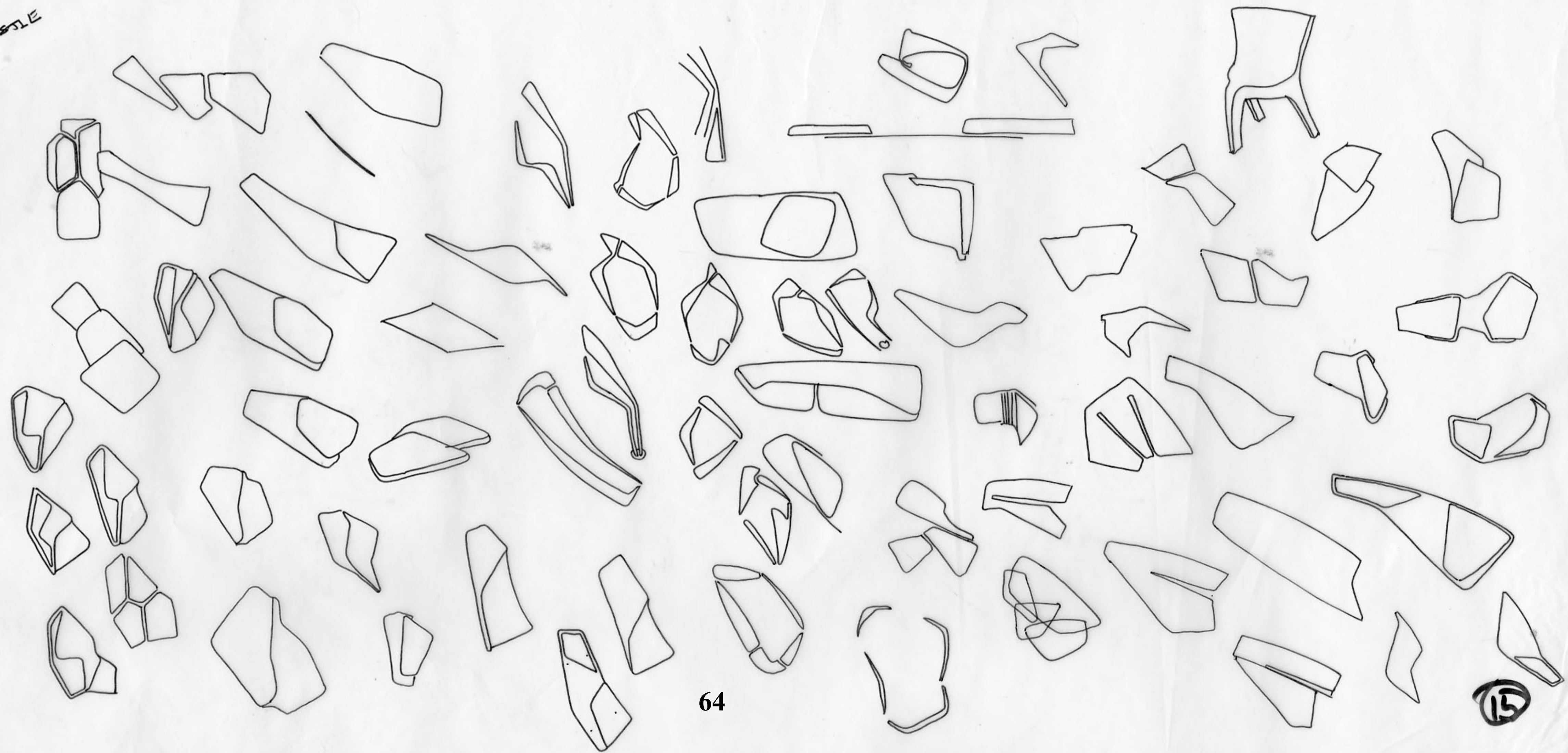


13

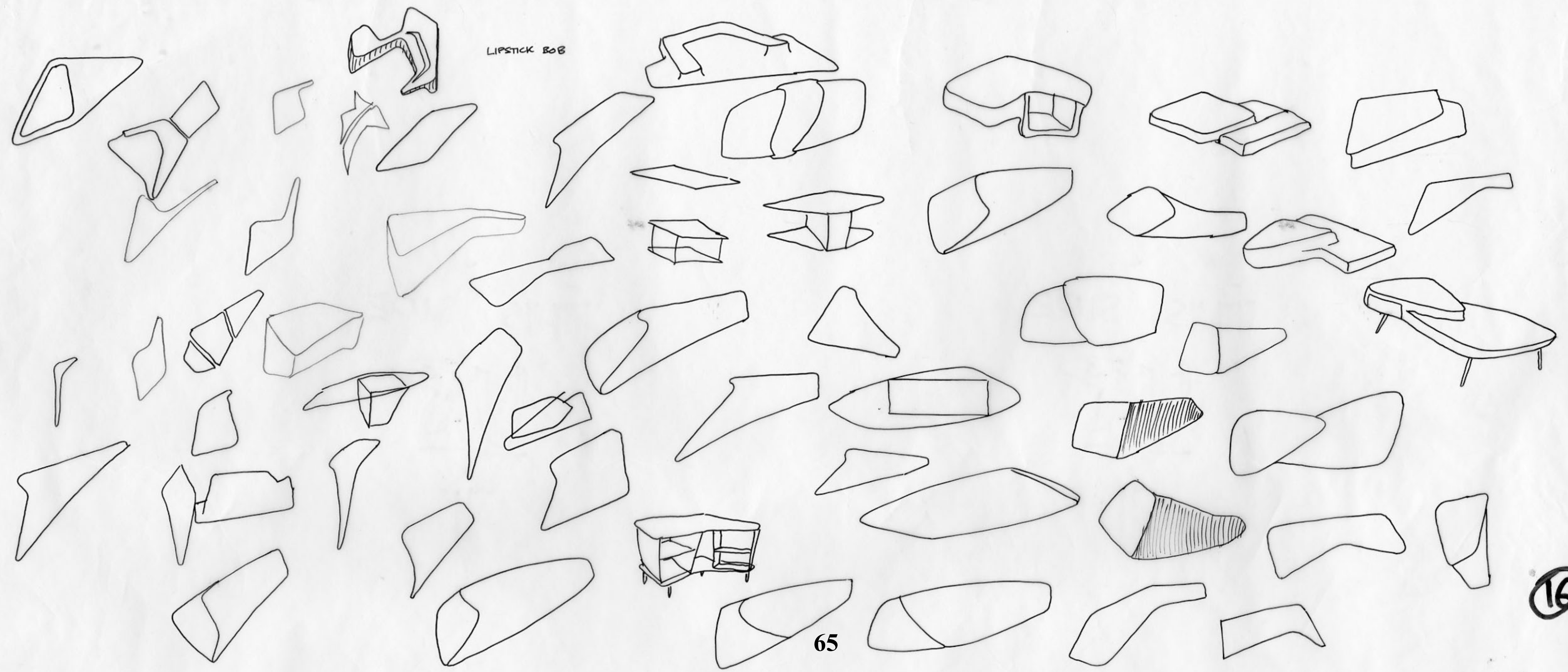


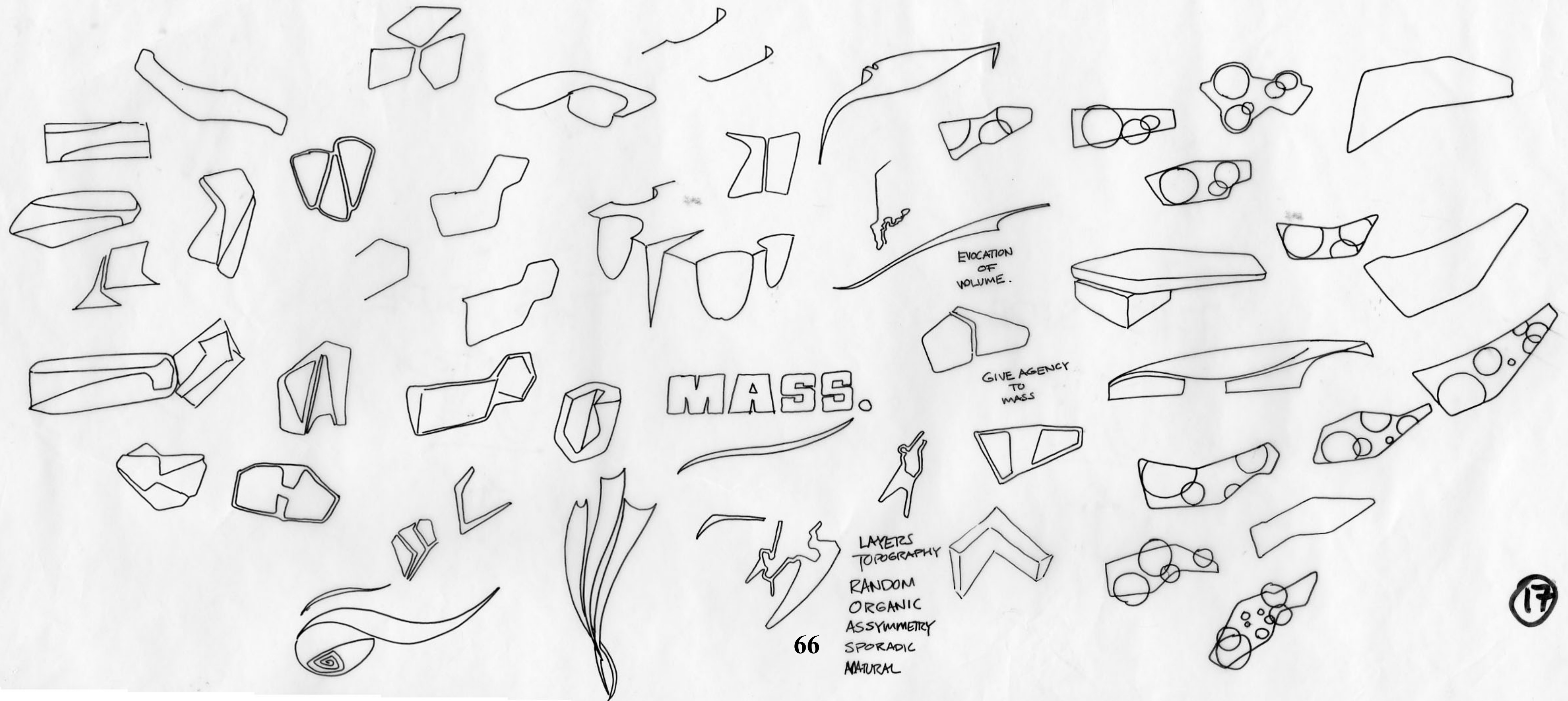
ALGORITHM
OR AL-GORE-RHYTHM

WENDELL CASTLE



LIPSTICK BOB





MASS.

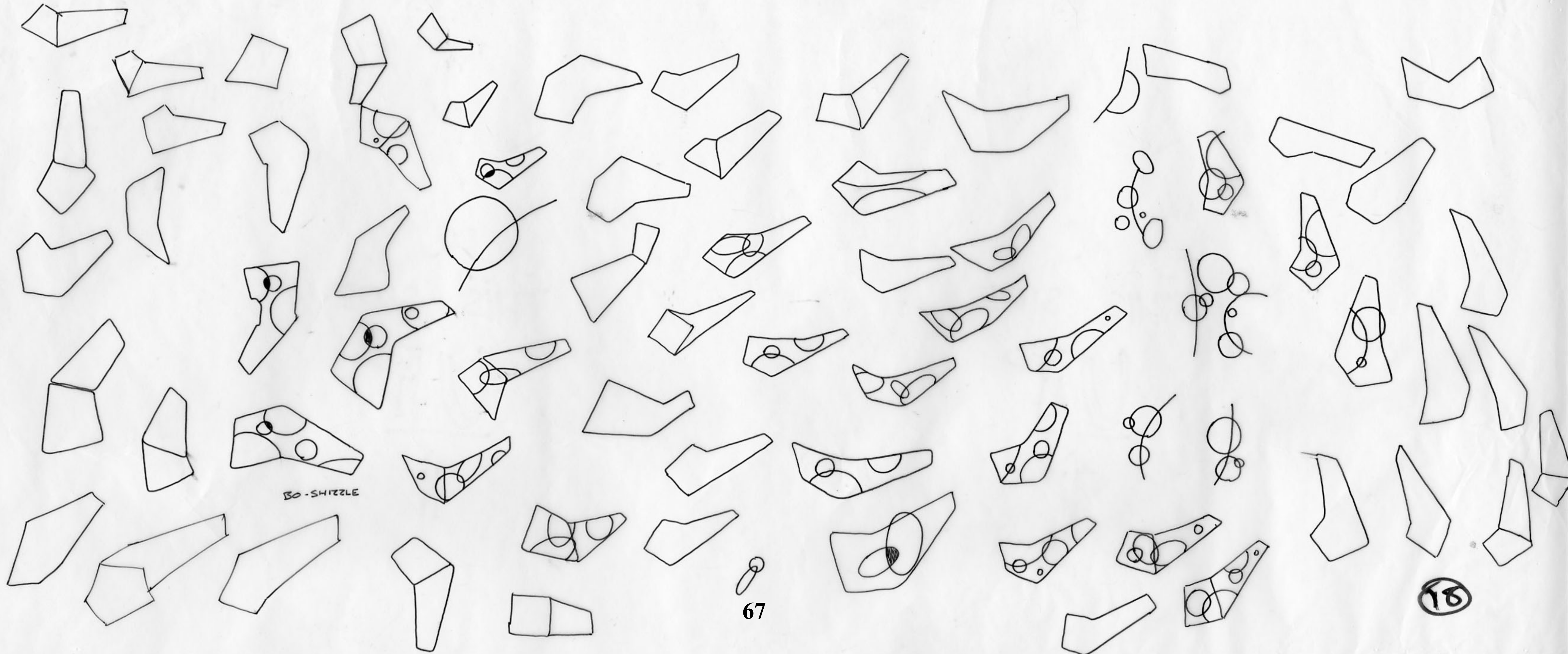
EVOCATION
OF
VOLUME.

GIVE AGENCY
TO
MASS

LAYERS
TOPOGRAPHY
RANDOM
ORGANIC
ASSYMMETRY
SPORADIC
NATURAL

66

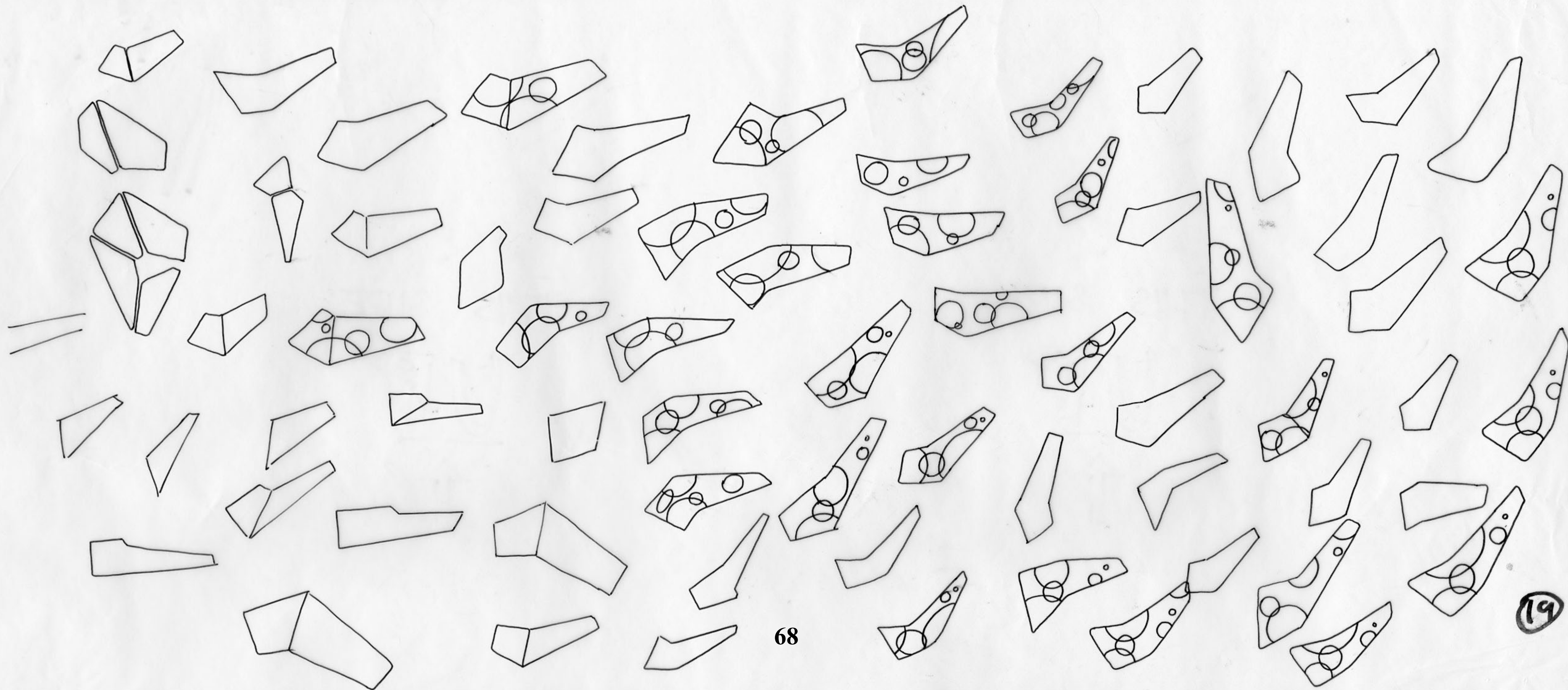
17

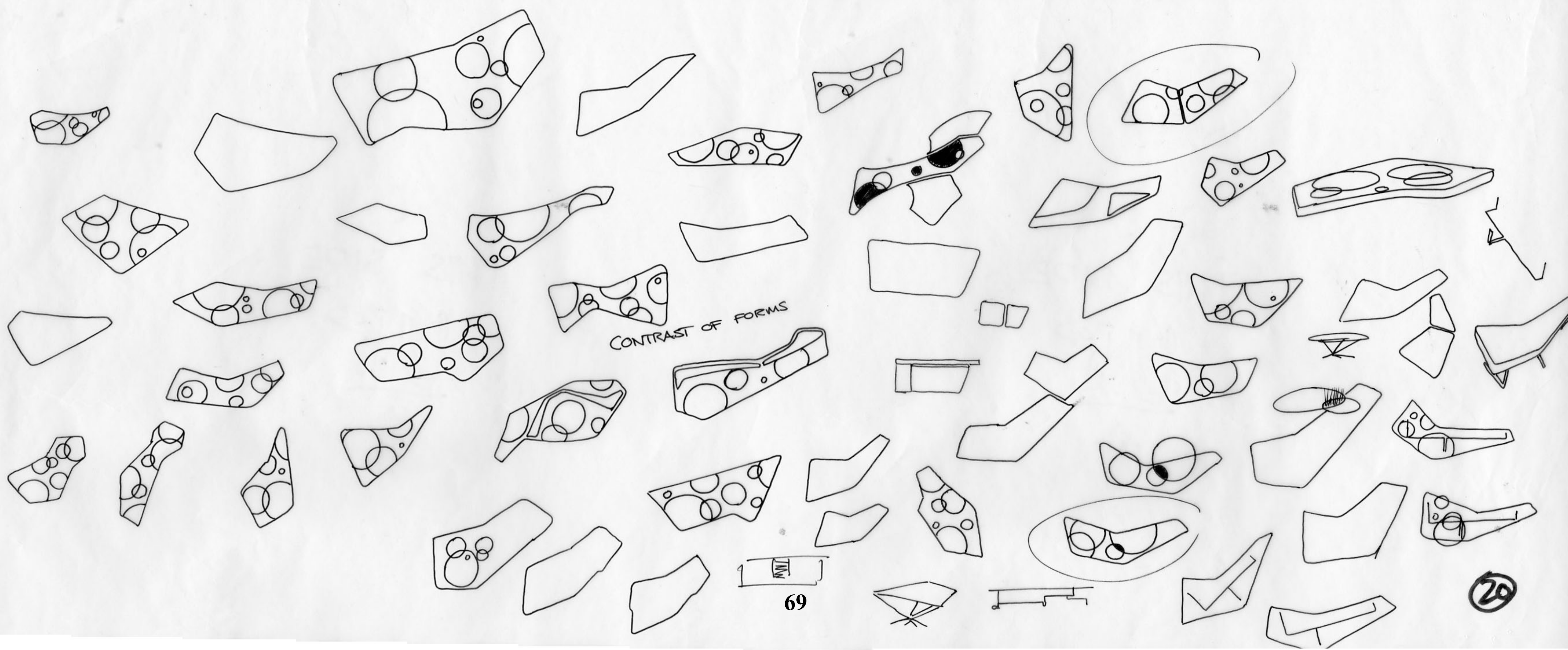


BO-SHIZZLE

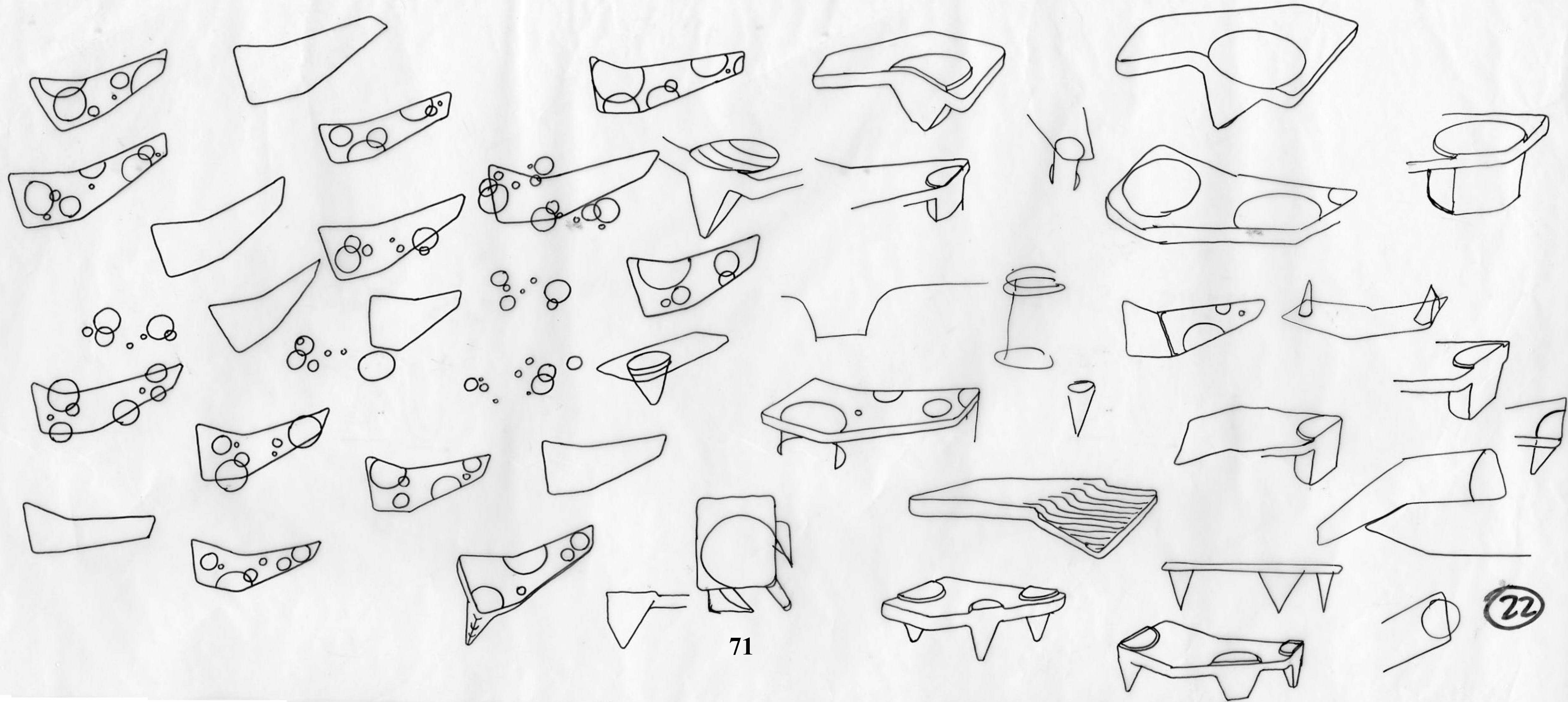
67

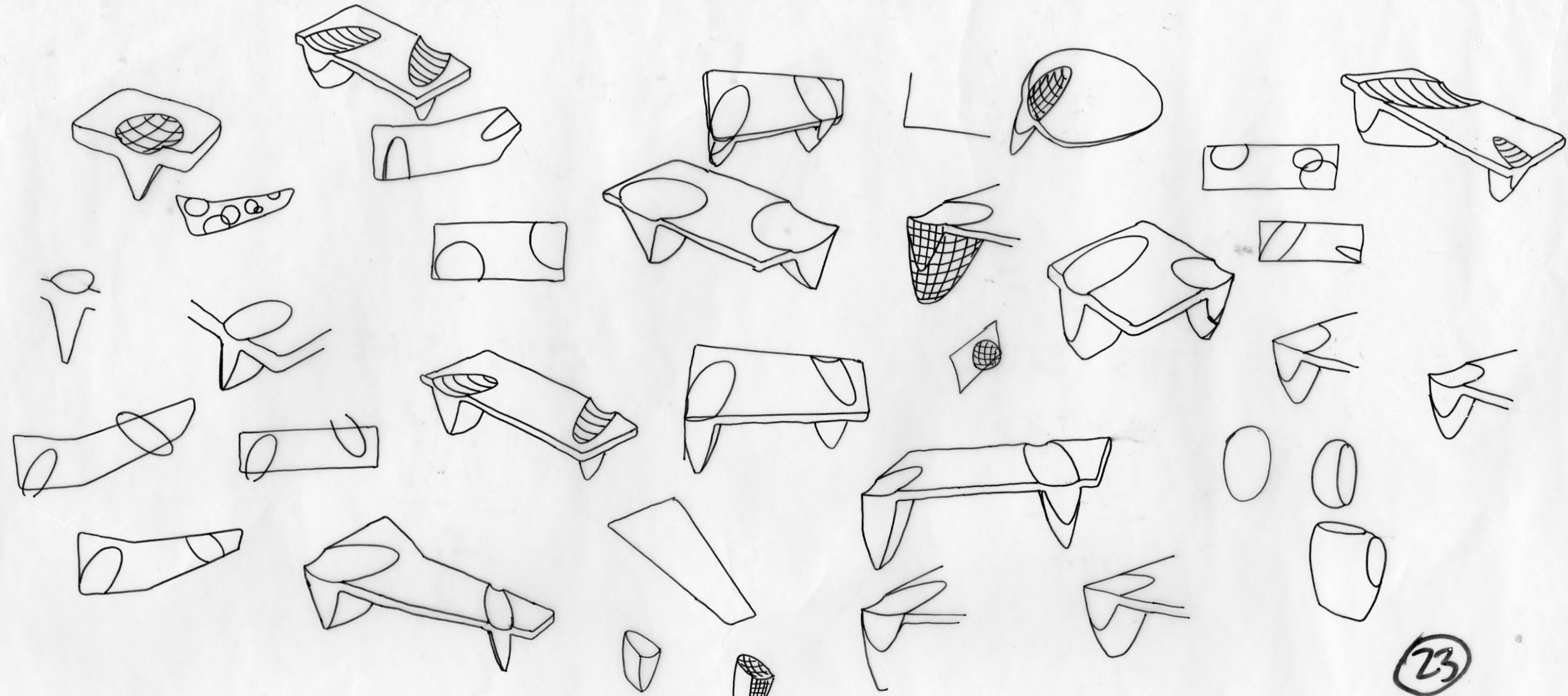
18

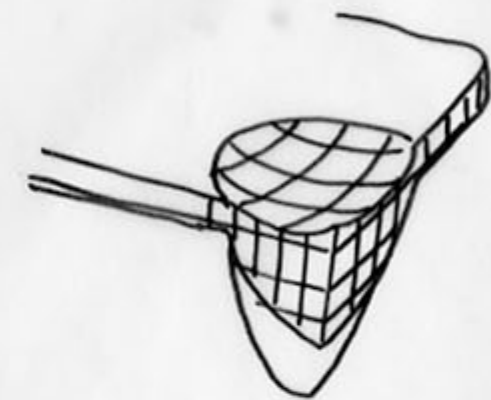
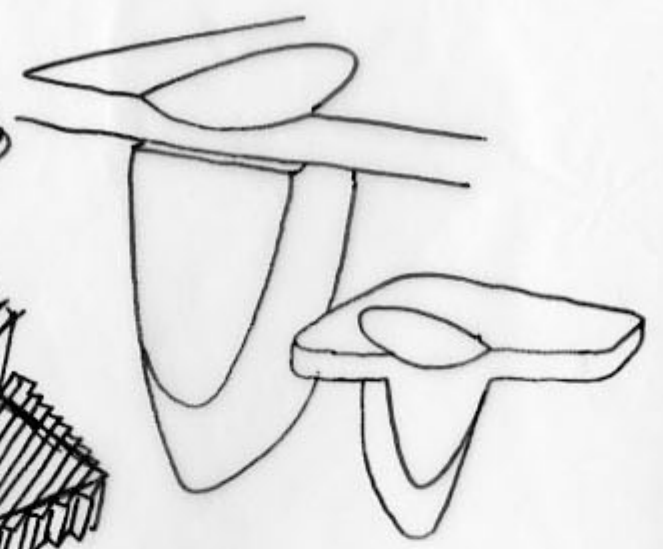
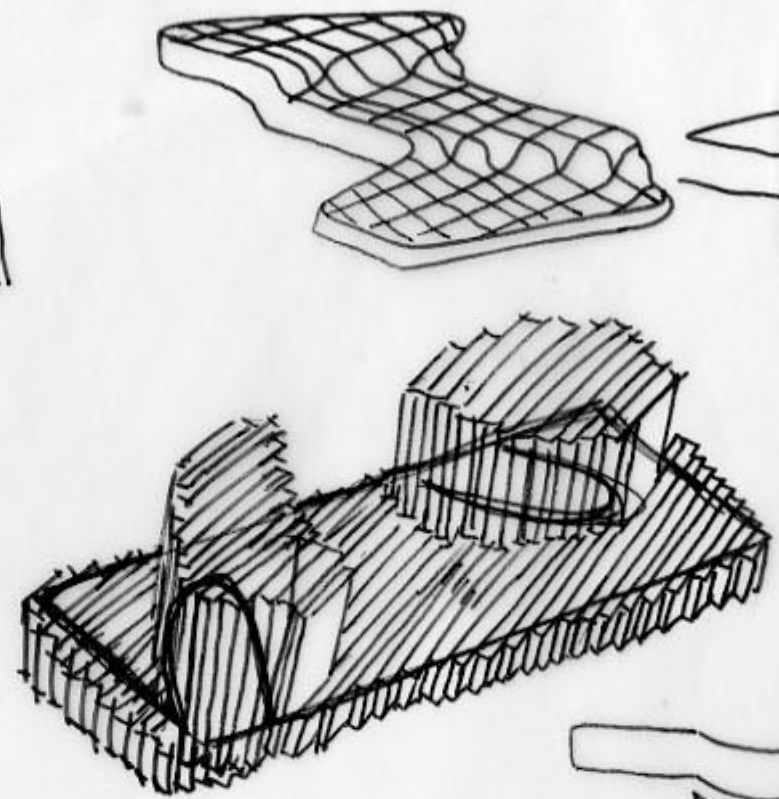
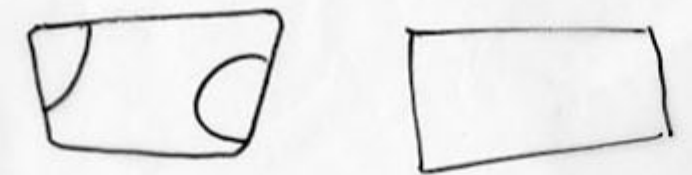
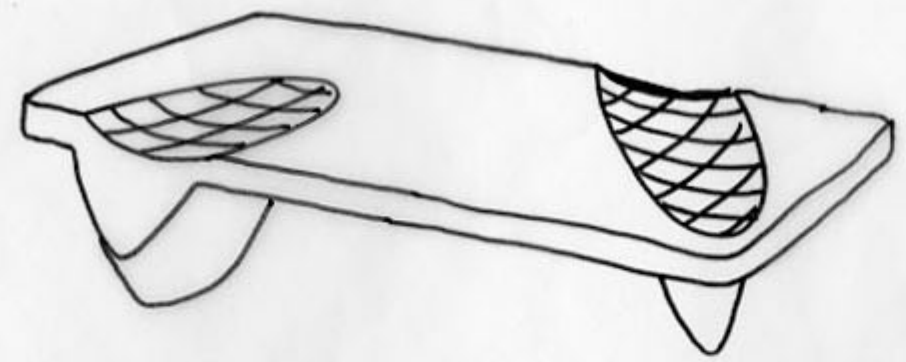
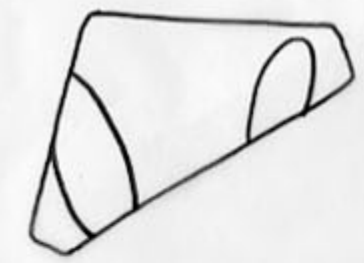




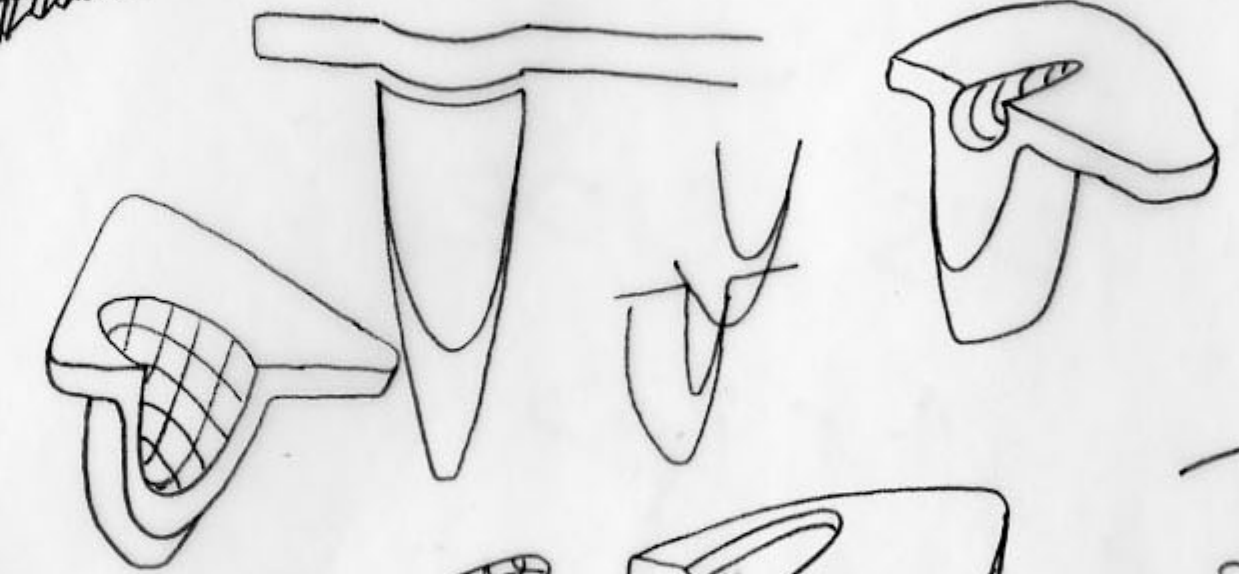
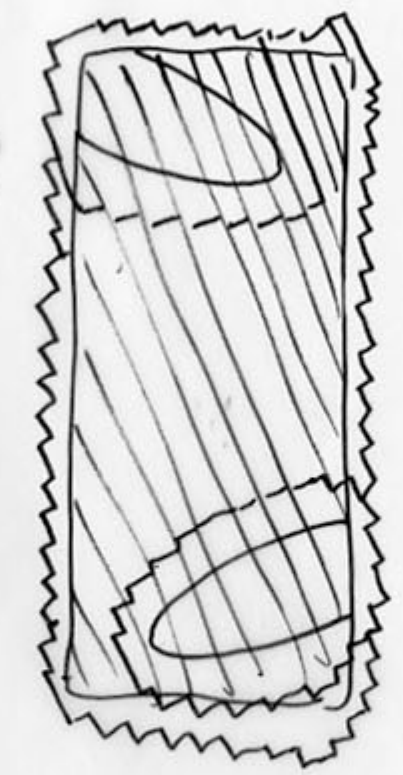
CONTRAST OF FORMS



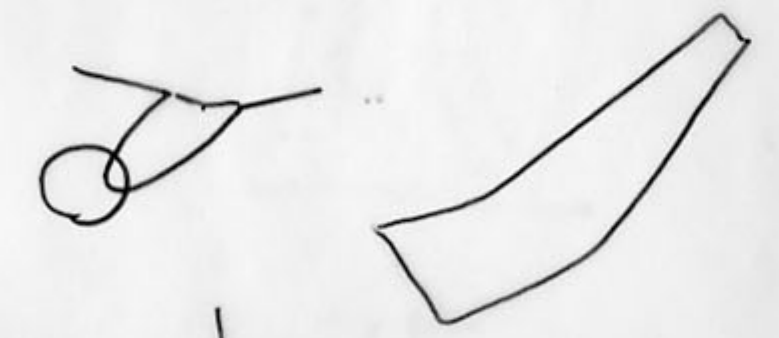




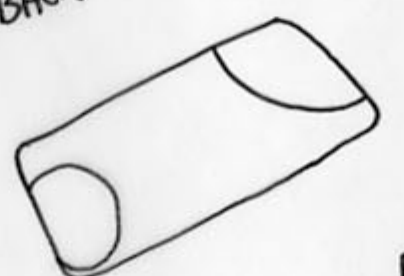
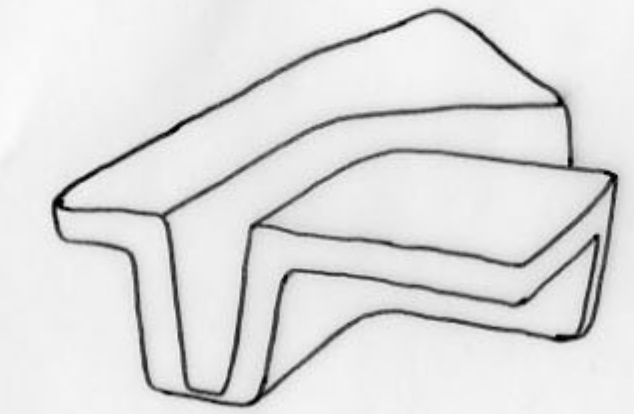
RAGE AGAINST THE SPEEDWAGON

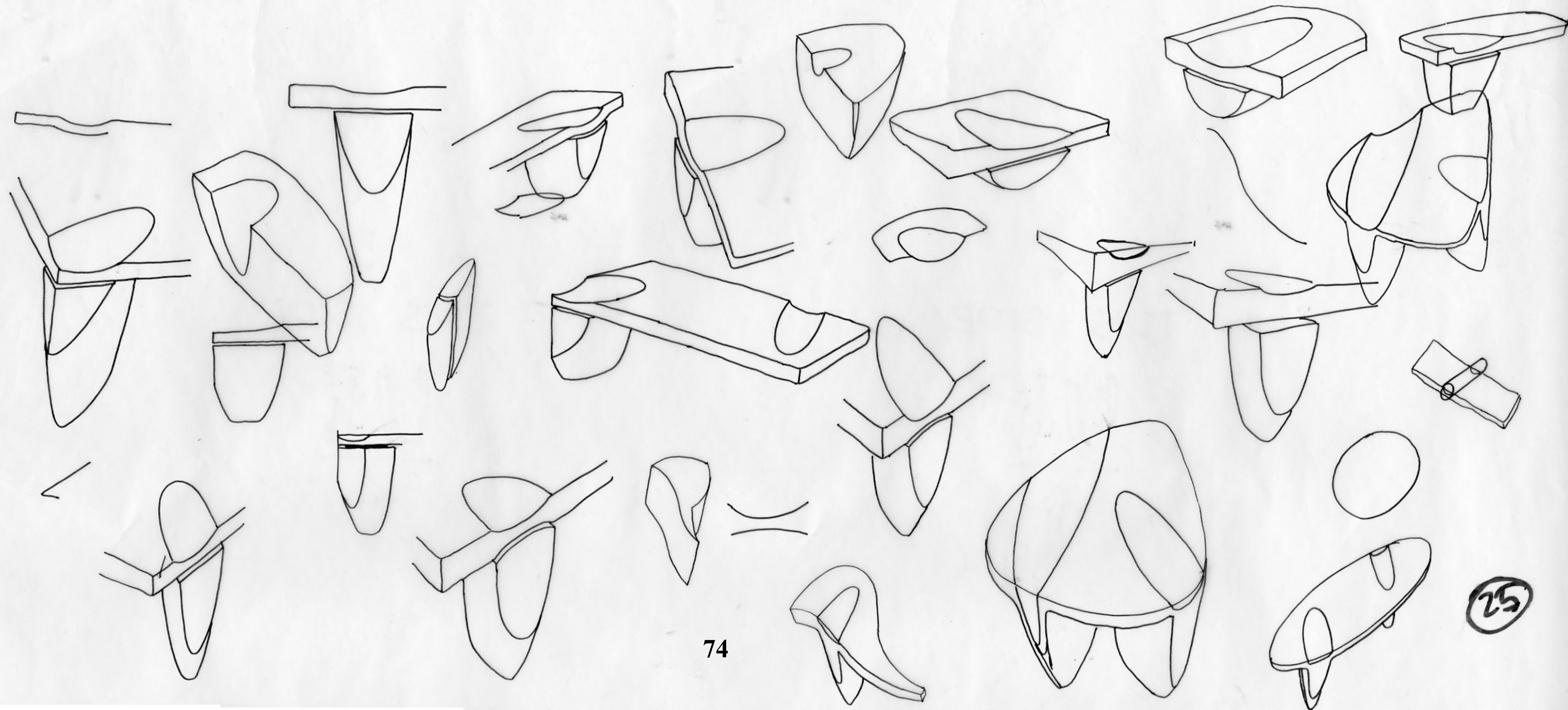


CAPTIVATING AESTHETIC OBJECT

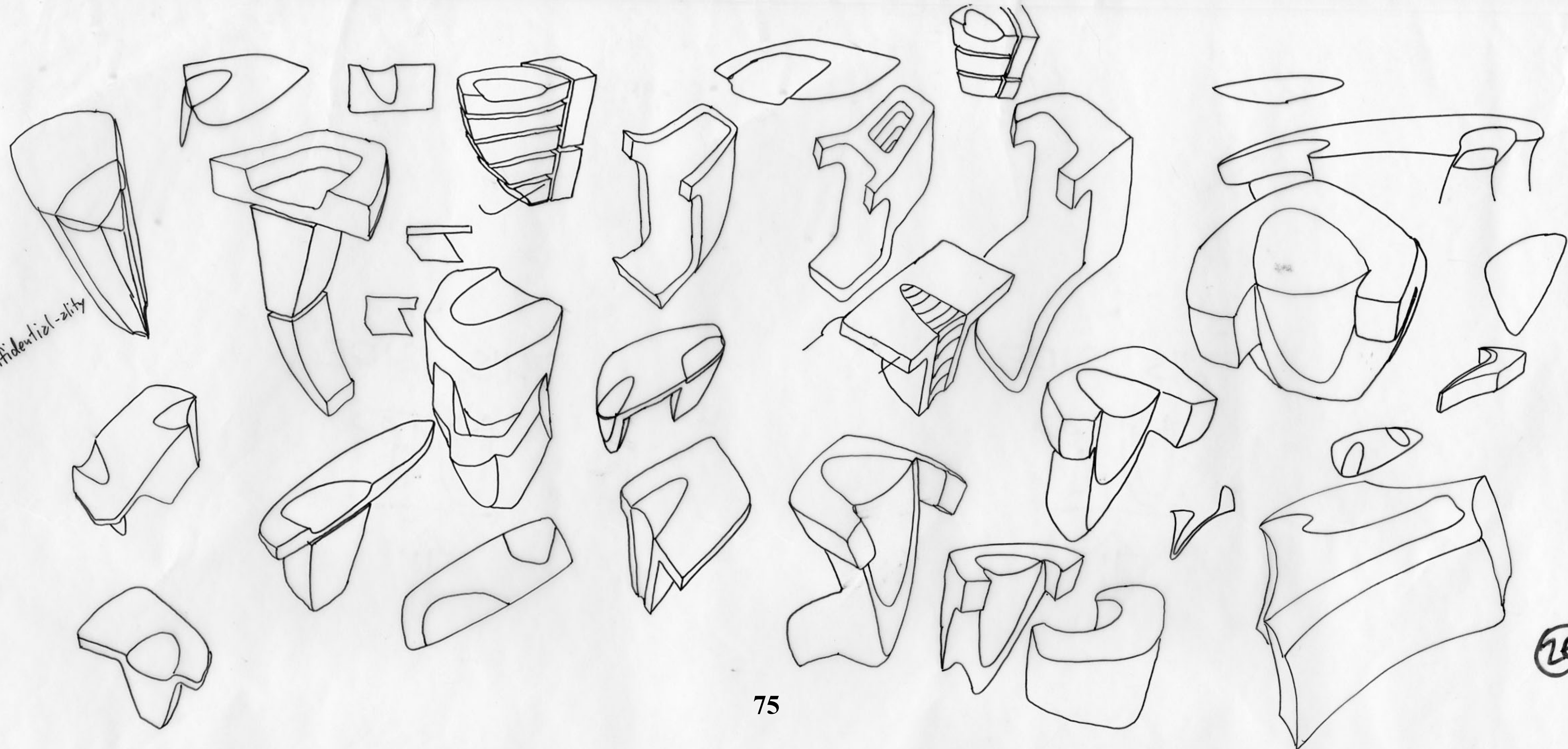


ST. FEEDBACK





Confidentiality



APPENDIX A: CONTINUED

FIGURES: GENERATIVE FORM MODELS

Figure 2: Generative Form Models (figure 2 includes 21 models)



Figure 2: Abstract Form Model



Figure 3: Abstract Form Model

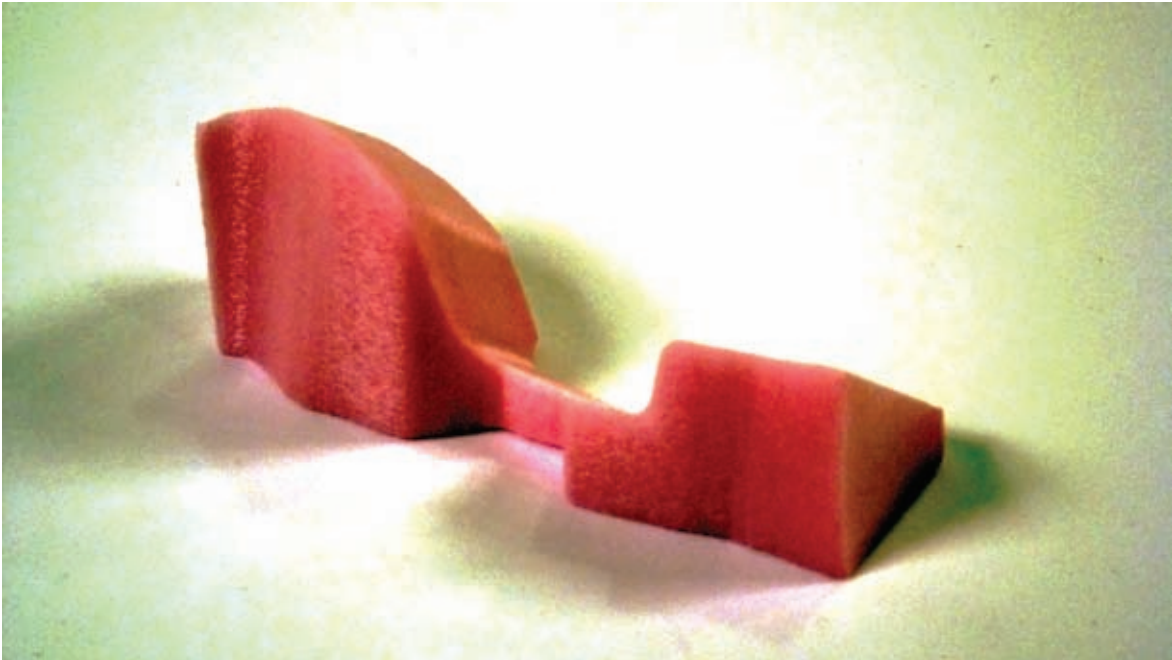


Figure 4: Abstract Form Model

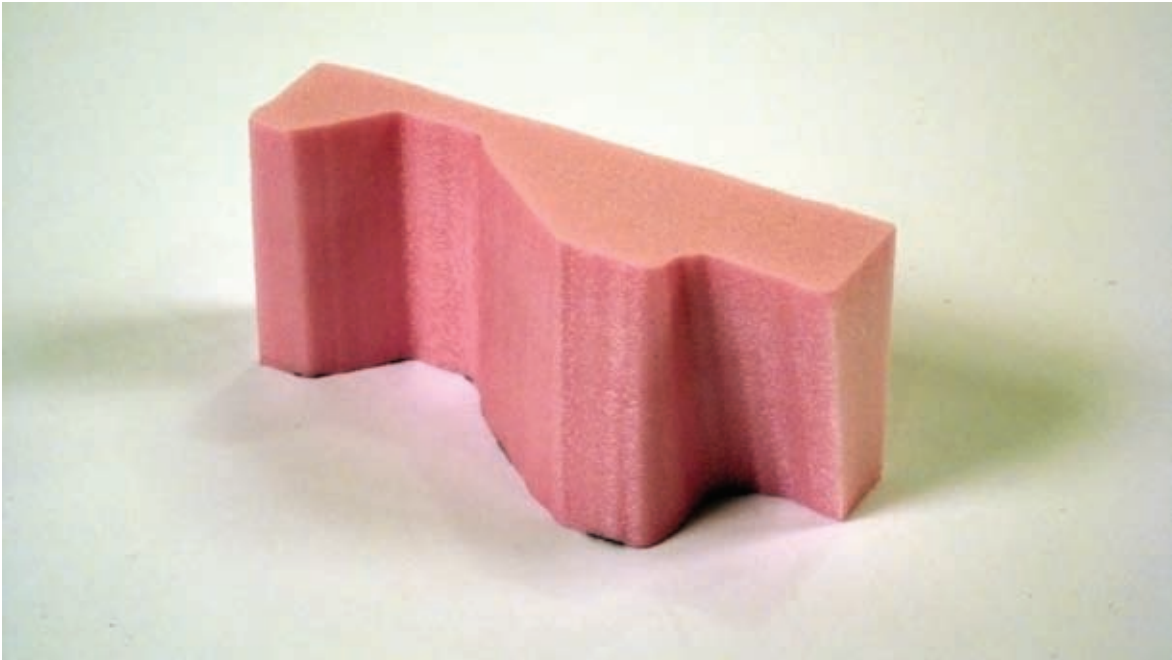


Figure 5: Abstract Form Model



Figure 6: Abstract Form Model



Figure 7: Abstract Form Model

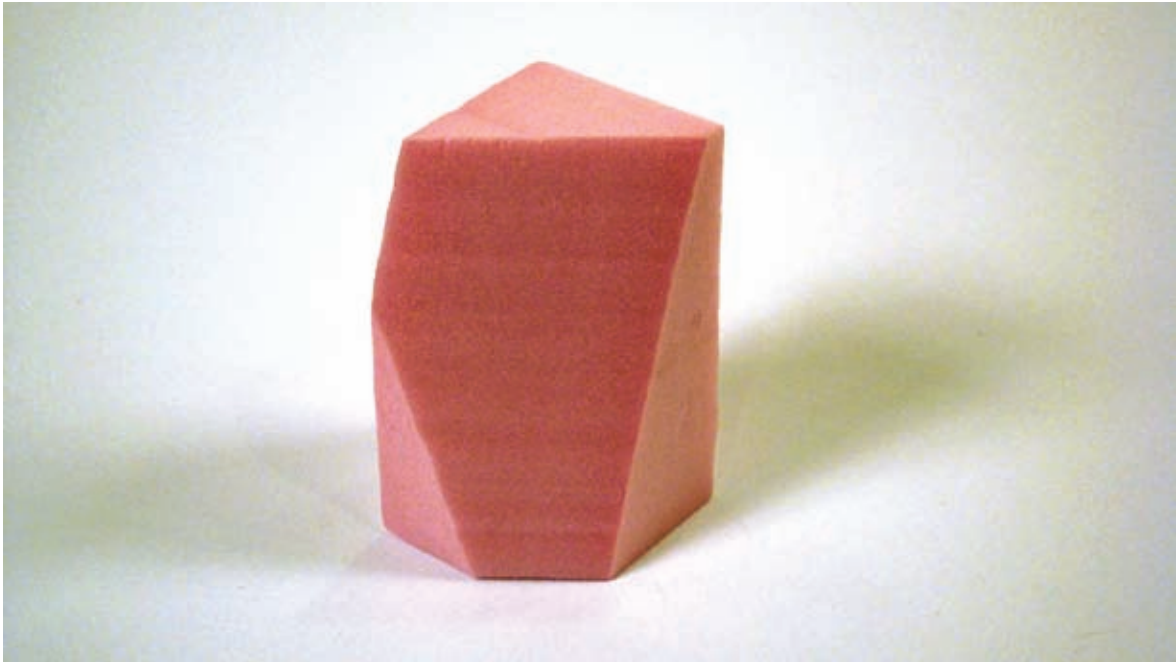


Figure 8: Abstract Form Model

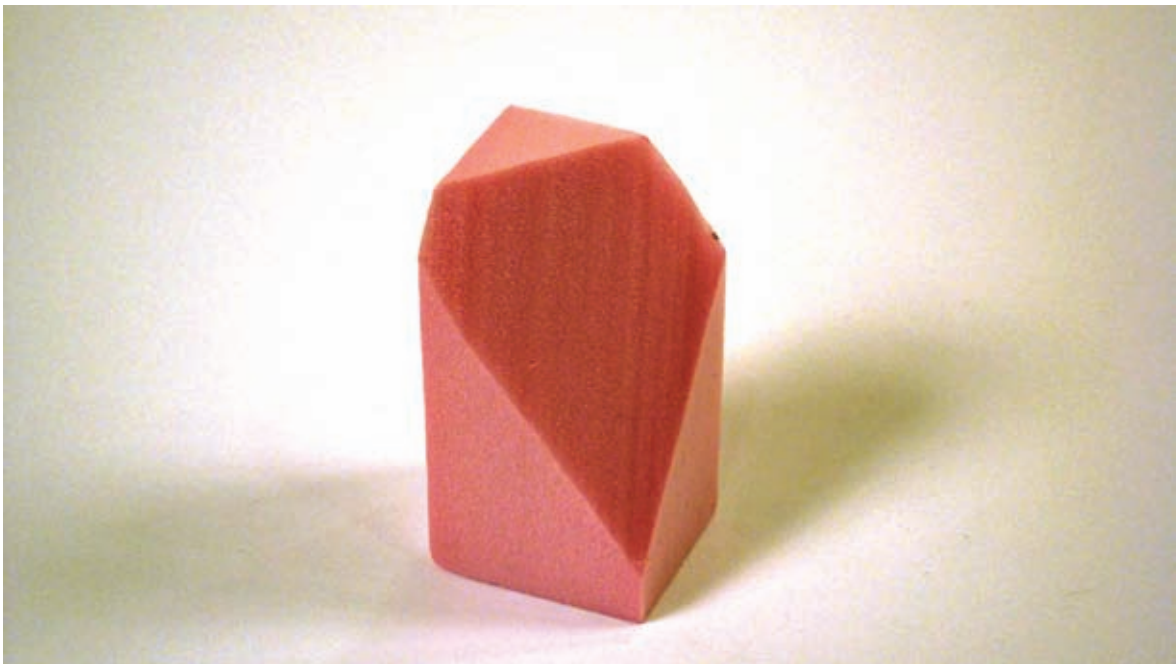


Figure 9: Abstract Form Model



Figure 10: Abstract Form Model



Figure 11: Typology Form Model



Figure 12: Typology Form Model



Figure 13: Planar Form Model



Figure 14: Planar Form Model

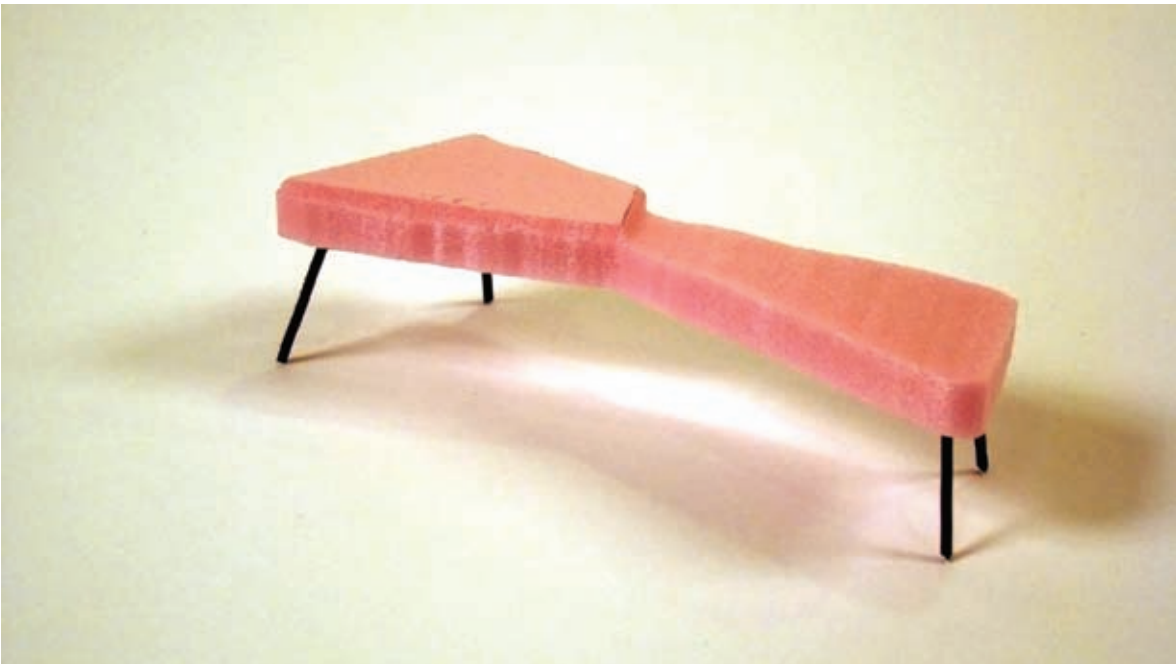


Figure 15: Planar Form Model



Figure 16: Form model



Figure 17: Form model



Figure 18: Form model



Figure 19: Form model



Figure 20: Form model



Figure 21: Form model



Figure 22: Form model

APPENDIX A: CONTINUED

FIGURES: FABRICATION AND FINAL PRODUCT

Figures 23-43

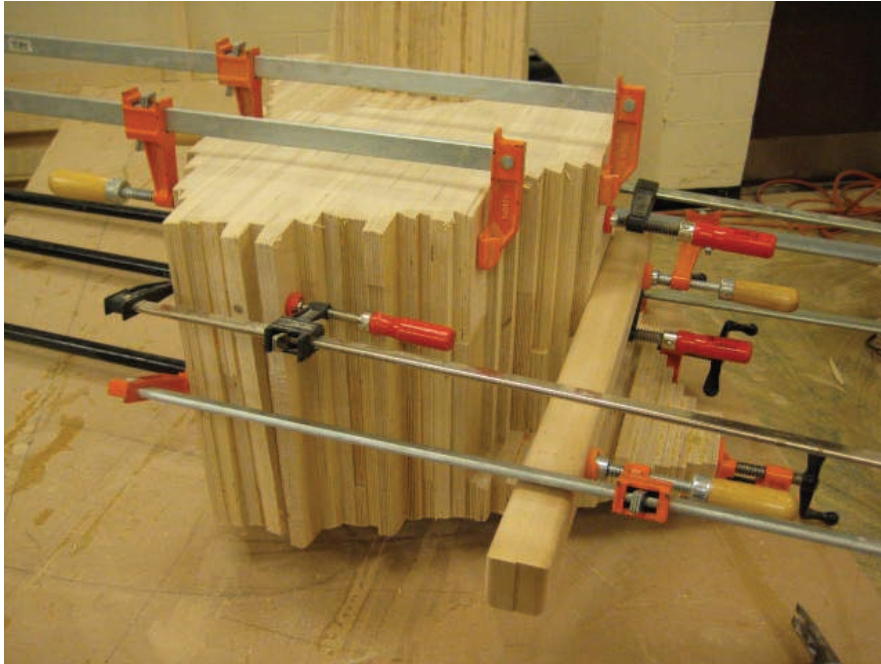


Figure 23: Glue-up and clamping



Figure 24: Glue-up and clamping



Figure 25: Glue-up and clamping



Figure 26: Rough/general shaping



Figure 27: Rough/general shaping



Figure 28: Rough/general shaping



Figure 29: Boundary shaping



Figure 30: Boundary shaping



Figure 31: Boundary shaping



Figure 32: Final shaping and sanding



Figure 33: Final shaping and sanding



Figure 34: Final shaping and sanding



Figure 35: Stain application



Figure 36: Stain application



Figure 37: Final product



Figure 38: Final product



Figure 39: Product detail



Figure 40: Product detail

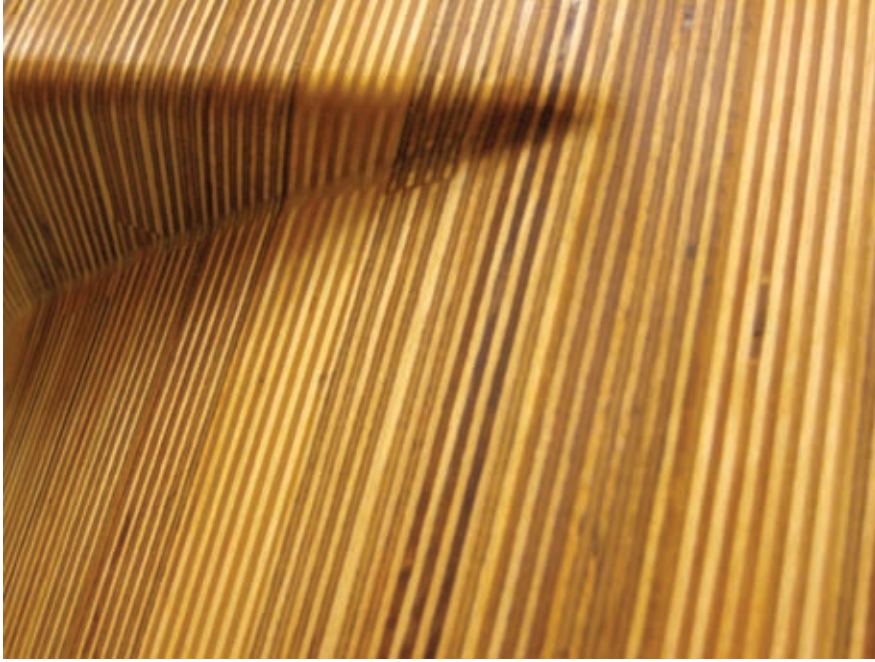


Figure 41: Product detail



Figure 42: Product detail

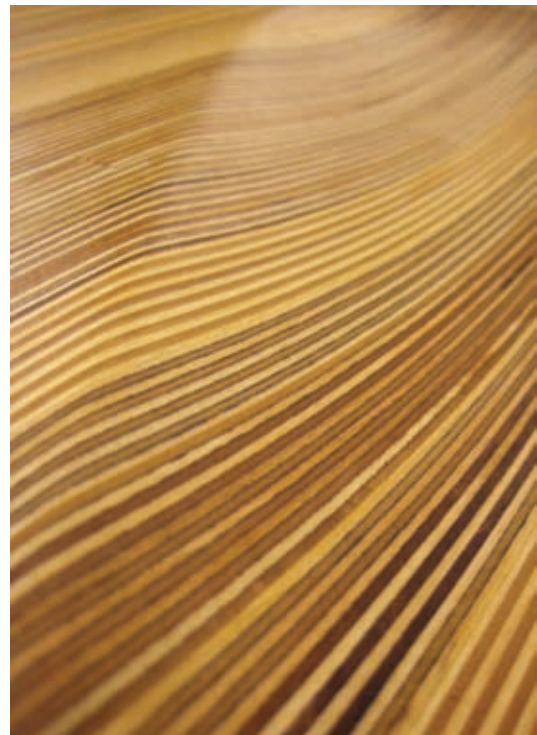


Figure 43: Product detail