Charcoal Gesture Drawing Informing Industrial Design Form Development

by

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Abstract

This thesis explores an alternative approach to industrial design ideation and iteration that develops students' visual literacy through the integration of charcoal gesture drawing and photographic communication. In contrast to some conventional industrial design workflows that emphasize precision and refinement in the early stages, this methodology prioritizes the development of visual analysis skills through expressive, gestural drawing techniques rooted in fine arts practice.

Students engage with reference imagery gathered from art, architecture, and graphic design, emphasizing visually complex and formally driven sources. These references are deconstructed through charcoal gesture drawing to examine form, proportion, spatial relationships, and compositional hierarchy. This process trains the eye to identify and abstract essential visual information, enabling rapid ideation and iterative exploration before transitioning into refined sketches or digital tools.

Visual literacy is further reinforced through photographic documentation of final design outcomes. Students are required to communicate their objects using both objective photography, which clearly conveys form, material, and function, and subjective photography, in which context, framing, and visual narrative shape interpretation. By positioning drawing and photography as analytical and communicative tools rather than purely representational ones, this thesis proposes a hybrid framework that bridges artistic expression and industrial design practice. The resulting methodology offers an alternative to visually homogenized design outcomes and supports more intentional, articulate, and visually literate design processes.

Artificial Intelligence (AI) Use Disclosure Statement

In the preparation of this thesis, no Artificial Intelligence (AI) tools were used.

Digital Accessibility Disclosure Statement

In the preparation of this thesis / dissertation, the following digital accessibility tools were used to ensure this document complies with federal requirements: Auburn Accessibility Checklist. The author acknowledges full responsibility for the intellectual content of this work and has made a good faith effort to comply with digital accessibility requirements in publishing, wherein the nature of the content does not significantly change in order to do so. Furthermore, all content has been reviewed and revised to meet these requirements prior to final publication.

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1.1 Problem Statement

Some contemporary industrial design education commonly emphasizes technical accuracy, software proficiency, and engineered solutions early in the design process, commonly at the cost of visual literacy and critical visual analysis. As a result, students may struggle to deconstruct visual references, understand why certain forms are found appealing, and translate visual inspiration into intentional design decisions. This gap limits their ability to explore form freely during ideation, articulate their visual intent, and communicate design outcomes effectively.

Additionally, reliance on narrow reference sources and rigid sketching methodologies may reinforce visually homogenized design solutions that mirror existing market patterns rather than challenge them. Without structured opportunities to engage with expressive media, analyze diverse visual disciplines, and practice visual communication beyond refinement, students may risk developing design processes that focus on safe or predictable forms over exploration, using trends or market patterns as a crutch rather than as fuel for inspiration. (Milton Glaser, 2019b)

1.2 Need For Study

While charcoal gesture drawing has been widely explored within fine arts education, its use as a structured ideation and analytical tool in industrial design (particularly during early-stage concept development) remains under-examined. Industrial design pedagogy frequently prioritizes controlled media and precision-driven sketching, restricting opportunities for visual deconstruction, abstraction, and exploratory form-making. This gap indicates a need to investigate alternative procedures that strengthen visual literacy while complementing established design practices.

This study addresses the lack of research surrounding charcoal gesture drawing as a means of deconstructing visual references and generating form-driven ideation in industrial design contexts. Reframed as an analytical rather than representational tool, charcoal gesture drawing encourages designers to respond to material qualities and visual interference, reinforcing perceptual awareness and adaptive thinking during ideation.

Expanding ideation strategies is particularly relevant amid mounting market homogenization and disposability. Designers bear a responsibility to create objects of desire that are intentional, meaningful, and worth keeping. If alternative sketching methodologies support deeper visual analysis and exploratory thinking, then they can contribute to more considered and informed design decisions.

1.3 Objective of Study

- ✦ Investigate the role of charcoal gesture drawing as an ideation and iteration tool within industrial design education.
- ✦ Examine how engaging with expressive, resistive drawing media influences students' ability to deconstruct visual references drawn from art, architecture, and graphic design.
- ✦ Explore how objective and subjective photographic documentation affects students' ability to clearly communicate form, intent, and contextual meaning of their final designs.

1.4 Assumptions

Assumption 1:

It is assumed that students, regardless of their initial drawing proficiency, can improve their visual analysis and sketching skills through instruction, guided practice, and iterative feedback (Nelson, 1977, p.10). This study does not aim to measure innate drawing skill but assumes that engagement with alternative media can support skill development over time.

Assumption 2:

It is assumed that sketching functions as a primary cognitive and communicative tool within the industrial design process, enabling designers to externalize, explore, and iterate on ideas during early-stage ideation (Milton Glaser, 2019b). The study accepts sketching as an established and effective method for visual reasoning and problem-solving.

Assumption 3:

It is assumed that a student's ability to visually analyze, frame, and communicate a designed object through photography reflects aspects of their visual literacy. Objective and subjective photographic outputs are treated as indicators of a student's capacity to read visual language and intentionally convey form, context, and design intent to others (Adams et al., 1978; Szarkowski, 2018).

1.5 Scope and Limits

This thesis concentrates on integrating fine-arts–informed sketching methodologies, with particular emphasis on charcoal gesture drawing, into the ideation and early sketching phases of industrial design education. The scope of this investigation is limited to examining how expressive, freeform drawing techniques can support visual analysis, exploratory form development, and iterative thinking within a structured studio environment.

Additionally, this thesis does not evaluate long-term market performance, user behavior, sustainability metrics, or the commercial viability of resulting designs. Its conclusions are limited to inferred impacts on student ideation processes, visual literacy, and communication methods (specifically, drawing and photographic representation) during the study period.

1.6 Anticipated Outcomes

This study anticipates that utilizing charcoal gesture drawing and photography in the industrial design process could improve students' visual literacy, particularly in visual deconstruction, iterative ideation, and design communication. Students are expected to demonstrate greater formal exploration during early ideation and greater clarity in communicating design intent through both objective and subjective photographic representations.

1.7 Definition of Terms and Acronyms

Aesthetics -

Pleasing in appearance: attractive (“Definition of Aesthetics”, n.d.)

Applied arts -

Artistic designs made for utilitarian objects in everyday use (Applied Art: What is Applied Art Definition?, n.d.)

CAD-

Computer-Aided Design

Charcoal -

a dark or black porous carbon prepared from vegetable or animal substances (as from wood by charring in a kiln from which air is excluded) (“Definition of Charcoal”, 2019)

Concept -

something conceived in the mind: THOUGHT, NOTION (Definition of CONCEPT, 2019)

Craft -

an occupation, trade, or activity requiring manual dexterity or artistic skill (Merriam-Webster, 2019)

Design Thinking -

Design thinking is a mindset and approach to problem-solving and innovation anchored around human-centered design (Han, 2022)

Drawing -

The art or technique of producing images on a surface, usually paper, using marks, usually with ink, graphite, chalk, charcoal, or crayon (Hutter, 2019)

Fine art -

Concerned primarily with the creation of beautiful objects—usually used in plural ("Definition of Fine Art", 2019)

Form -

The shape and structure of something as distinguished from its material ("Definition of Form", 2019)

Gesture -

A gesture drawing represents the essence of an object's or figure's position. It is the act of creating a drawing or sketch with a loose grip and movement of the drawing tool used. Gesture drawings are often very expressive and allow one the freedom to loosen up and not worry about small details. Gesture drawings are an ideal way to warm up before one starts to concentrate on a more intense drawing exercise ("Creative Glossary", 2024).

Human Centered Design -

A problem-solving technique that puts real people at the center of the development process, enabling you to create products and services that resonate and are tailored to your audience's needs (Landry, 2020).

ID-

Industrial Design

Iteration -

The process of doing something again and again, usually to improve it, or one of the times you do it (Cambridge Dictionary, 2024).

Mind's Eye -

The mental faculty of conceiving imaginary or recollected scenes; also: the mental picture so conceived (Merriam-Webster Dictionary, 2023)

Moodboard-

A collection of objects, images, etc., that is assembled often on a flat surface and used as inspiration for something (such as a design or goal) (Merriam-Webster Dictionary, 2023)

Orthographic -

Of, relating to, being, or prepared by orthographic projection (Merriam-Webster Dictionary, 2024)

Orthographic Projection -

1 : Projection of a single view of an object (such as a view of the front) onto a drawing surface in which the lines of projection are perpendicular to the drawing surface

2 : The representation of related views of an object as if they were all in the same plane and projected by orthographic projection (Merriam-Webster Dictionary, 2021)

Render -

Rendering is the process which converts the scene of 3D objects and lights into a 2D image or collection of 2D images. (Eastman, 2015)

Sketch -

Traditionally a rough drawing or painting in which an artist notes down [their] preliminary ideas for a work that will eventually be realized with greater precision and detail. (Britannica Editors, 2011)

Still-life -

1: A picture consisting predominantly of inanimate objects

2: The category of graphic arts concerned with inanimate subject matter (“Definition of Still Life”, 2020)

Semantic-

Of or relating to meaning in language (“Definition of Semantic”, 2019)

Semantic Differential-

Semantic differential scales are a popular type of survey question used in market research to measure attitudes toward a particular concept or object. This type of scale uses a series of bipolar adjectives or phrases to evaluate the respondent’s perception and evaluation of a concept or object (Kuhn, 2023).

Semiotics-

The name of the discipline that brackets the conjoined scientific study of both verbal and nonverbal systems of communication (Sebeok, 1984).

STEM-

Science, Technology, Engineering, and Mathematics

Chapter 2

Literature Review

2.1 History and Background

2.1.2 Drawing in Antiquity

Drawing and sketching have held vital roles in human civilization for over 70,000 years, providing some of the earliest records of human thought, creativity, and communication. Initially, these artworks took the form of simple lines and shapes that represented “objects or living organisms,” commonly featuring animals and human figures in stylized or anthropomorphic forms (“The History of Drawing”, n.d.). Some of the earliest surviving examples are Paleolithic cave paintings, such as those at Lascaux, which depict animals and abstract symbols (Lascaux, n.d.).

Drawing became a means of communication in early civilizations, especially as writing systems were developing. Examples like the hieroglyphics found in Egypt are pictographs used for drawn, symbolic communication. These symbols were critical to making oneself understood in a time before widespread literacy (“The History of Drawing”, n.d.). Unlike today’s examples, which often attempt to recreate perspective and depth, ancient drawings lacked dimensionality. Ancient Egyptian art reveals a unique approach to human representation: backgrounds appear without perspective, with bodies facing the viewer while heads are drawn in profile. This style of depiction lasted until the 14th Century, when the Renaissance began.

The development of perspective marked a turning point in the history of drawing and sketching. During the Renaissance, artists and scholars sought a more accurate

Figure 1: The interior of Brunelleschi's Church of Santo Spirito (Brunelleschi, n.d.)

Figure 2: Raphael: Fresco (200 in × 300 in)
Apostolic Palace, Vatican Museums, Vatican City (Raphael, n.d.)

understanding of anatomy, spatial relationships, and the natural world, spurring the

development of techniques that enabled three-dimensional representation on a two-dimensional surface (“The History of Drawing”, n.d.). Artists like Leonardo da Vinci studied human and animal anatomy, while mathematicians like Brunelleschi formalized linear perspective, allowing artists to create depth and realism (Hyman, 2019).

By the 18th century, Gaspard Monge’s development of descriptive geometry added another dimension to the utility of drawing, providing a mathematical system that accurately depicts three-dimensional objects on a two-dimensional plane.

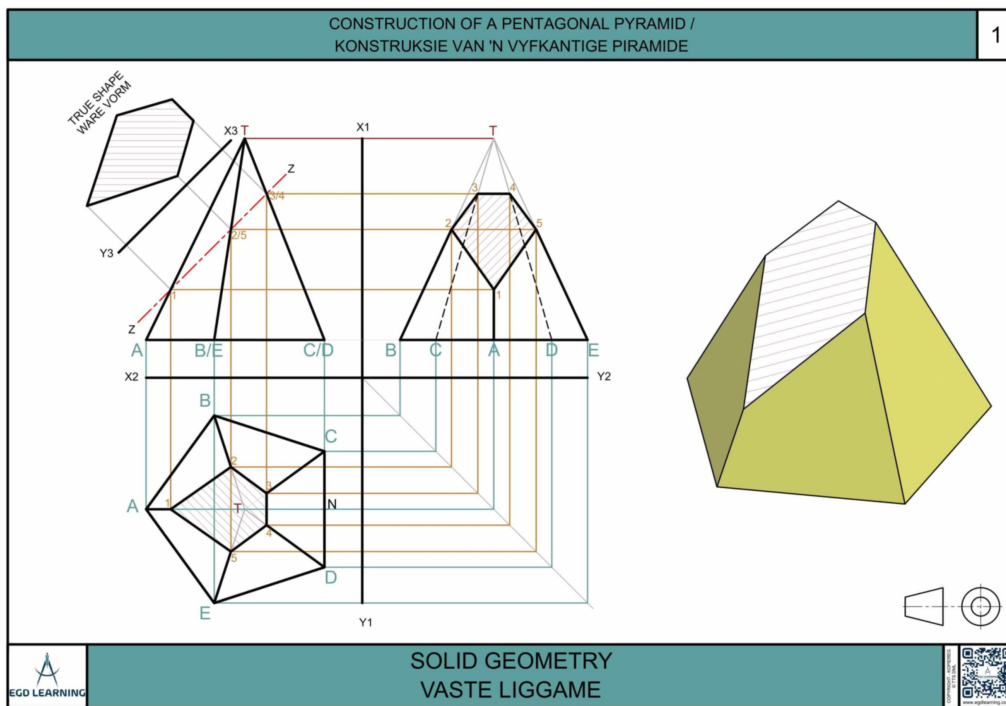


Figure 3: Descriptive Geometry
(EGD Learning, 2024)

Monge was serving the French military as an engineer when he developed the system for designing military fortifications. The system of interlocking stones made it so that the walls and turrets were able to withstand bombardment (“2 Basic Concepts of Descriptive Geometry”, n.d.). The method of descriptive geometry was declared a

military secret and was not made public until around 1790. Monge made descriptive geometry a part of the education for both engineering and architecture while working as a professor at the Beaux-Arts (“2 Basic Concepts of Descriptive Geometry”, n.d.).

Descriptive geometry would form the theory that allows for orthographic projections, providing the numerical foundations for orthographic drawings. This representation became fundamental for architects, engineers, and later designers, enabling them to visualize and solve complex spatial problems on paper before construction or manufacturing (Pipes, 2007).

2.1.3 Sketching for Manufacture

Figure 4: Joseph Benoît Suvée, Invention of the Art of Drawing (Suvee, 1791)

In early instances, as seen in Greek mythology, sketching served as a form of creative expression and communication between artists and artisans. The first example of a sketch for manufacture comes from Greek mythos. Dibutades, the maid of Corinth, traced the shadow of her lover on a wall for her father to later turn into a sculpture (Pipes, 2007). This instance is considered the earliest example of sketching for manufacture and of the connection between drawing and three-dimensional creation.

As civilization advanced, sketching for manufacturing became a practical skill primarily associated with architecture and engineering, especially during the Industrial Revolution's age of mass production. With the onset of mechanization, sketches served as an intermediary language between creators and producers, and it became necessary to translate creative ideas into production instructions as production moved away from in-house production (Pipes, 2007). Architectural and engineering sketches evolved to precise measurements, functional requirements, and aesthetic qualities, shifting from purely artistic renderings to technical communication tools.

The Industrial Revolution marked a transformative period in modern history, shifting economies from agrarian and handicraft-based systems to those dominated by industrialization and machine manufacturing. This transition, which began in Britain in the 18th century, introduced cutting-edge technologies that transformed social systems and ways of life (Zeidan, 2024). Among its many impacts, the revolution irrevocably disrupted the traditional relationship between creators and their products. Craftsmen, who once maintained a close, hands-on connection with their work, faced a decline in their roles as mass production and mechanization replaced many aspects of handmade craftsmanship.

This upheaval was met with resistance and conflict as artisans coped with the loss of their livelihoods to machines. Notably, the Luddite riots of 1811 in England exemplified this turmoil. Skilled handcraft workers, particularly weavers in Nottinghamshire, protested against reduced wages and the widespread adoption of mechanical looms. These workers targeted employers, magistrates, and even food merchants, engaging in acts of sabotage against machinery. As historical records note, clashes between Luddites and government soldiers ensued, but their efforts ultimately failed as humanity marched forward, ushering in the machine age (Archives, n.d.).

2.1.4 Artist for Industry

The formalization of "industrial design" began in the early 19th century, when manufacturers recognized the value of design in consumer products. In 1940, Harold Van Doren's text was published. This book introduced the new profession of industrial design and its place in industry. Van Doren (1940) described the profession as something that has always been with humanity, arguing that although individuals have always been designing, their works were previously ineffectual.

Early industrial designers often found themselves "…straddling the line between artist and engineer," tasked with blending aesthetics and functionality to create products that were visually appealing and practical (IDSA, 2019, para. 1). These early designers frequently served as intermediaries, called in to refine products for the mass market by enhancing their aesthetic or market appeal. This role in the industry would later be classified as a 'stylist' in this context, rather than an industrial designer, because of the

individual's primary concern with aesthetics rather than the function of the designed object (Munari, 2008).

2.2 Education, Fine Arts, and ID

2.2.1 Gestalt Principals

Gestalt psychology, a twentieth-century school of thought foundational to modern theories of perception, is premised on the idea that the whole of a visual experience exceeds the sum of its individual parts, emphasizing patterns, configurations, and holistic organization rather than isolated elements (Britannica, 2019).

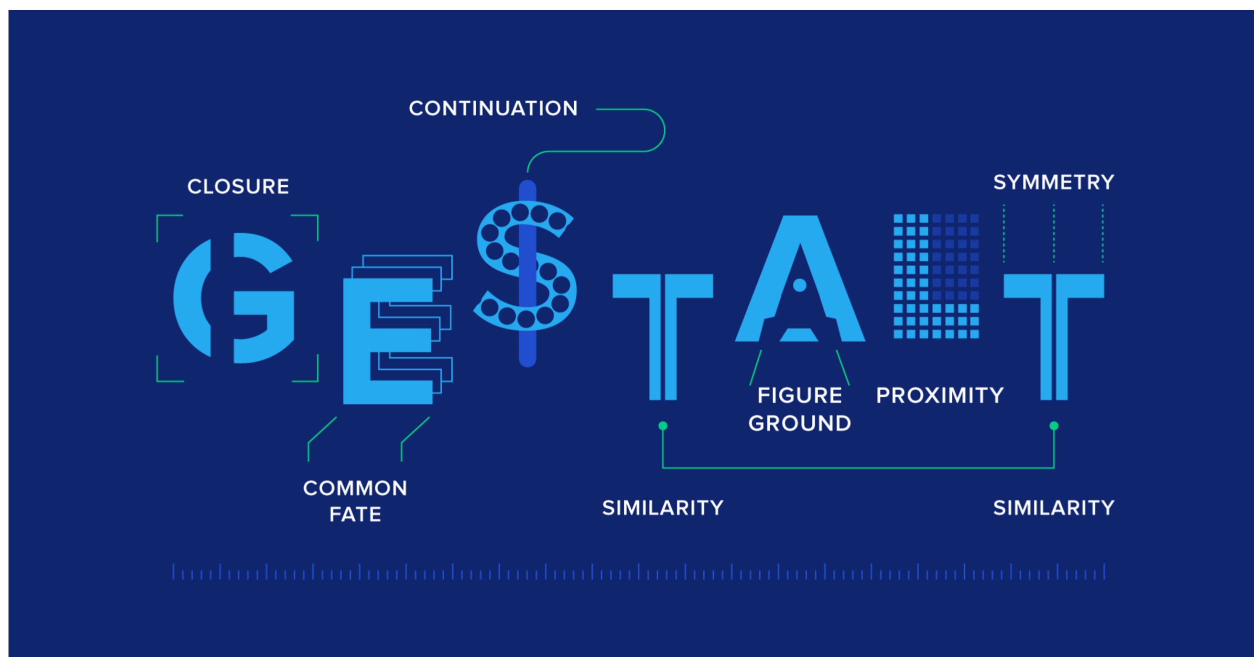


Figure 5: Gestalt principles: strategic design framework for UI/UX leaders (Benzehda, 2018)

The movement originated in 1910 when Max Wertheimer, inspired by the perception of motion in flashing railroad lights, began investigating what would later be termed apparent motion. After more than a year of research, Wertheimer published his

seminal 1912 paper, Experimental Studies of the Perception of Movement, marking a pivotal moment in the development of Gestalt psychology alongside collaborators Kurt Koffka and Wolfgang Köhler (Behrens, 1998). Their collective work fostered a research-driven academic environment, notably through a graduate program and the journal Psychologische Forschung, where students engaged directly in experimental inquiry, contributing to a lineage of influential figures such as Rudolf Arnheim and Kurt Lewin (Behrens, 1998). Although Gestalt psychologists were not practitioners of art or design, meaningful intersections emerged, particularly through Arnheim's engagement with the Bauhaus, "[i]n the 1920s, faculty at the Bauhaus and other schools analyzed form in terms of basic geometric elements. They believed this language would be understandable to everyone, grounded in the universal instrument of the eye" (Lupton & Phillips, 2015, p.11). The Bauhaus faculty experimented with these ideas from different angles as described here:

> "Wassily Kandinsky called for the creation of a "dictionary of elements" and a universal visual "grammar" in his Bauhaus textbook Point and Line to Plane. His colleague László Moholy-Nagy sought to uncover a rational vocabulary ratified by a shared society and a common humanity. Courses taught by Josef Albers emphasized systematic thinking over personal intuition and objectivity over emotion (Lupton & Phillips, 2015, p.11).

The connection between the Gestalt psychologist and the Bauhaus deepened through figures such as Josef Albers, whose exploration of perceptual phenomena like simultaneous contrast (originally identified by Michel-Eugène Chevreul) reinforced Gestalt principles by demonstrating that visual perception is inherently context-dependent and relational (Behrens, 1998; Lupton & Phillips, 2015. p.11-13).

Gestalt ideas also found their way into pedagogical approaches at the Bauhaus, where experimentation with materials and form echoed broader Gestalt emphases on experiential learning and perceptual wholes. Ultimately, Gestalt theory became closely aligned with modernist aesthetics, supporting the notion that design operates fundamentally as an abstract, formal discipline in which compositional relationships take precedence over representational content (Behrens, 1998).

2.2.2 Advent of the Bauhaus

The shift away from the master-apprentice model of learning, where skills were passed down in a highly personalized manner, created a need for a new educational approach suited to the demands of industrial production. Recognizing this gap, Walter Gropius established the Bauhaus in 1919, introducing an innovative teaching style that attempted to bridge the gap between fine arts and craft (Rice, 2023). Gropius' founding manifesto articulated the school's educational philosophy, emphasizing his belief that while art could not be taught, craftsmanship could be cultivated through structured training programs (Pipes, 2007).

Gropius proposed six core categories of craft training: sculpture, metalwork, cabinetmaking, painting and decorating, printing, and weaving. Drawing, treated as a separate discipline, encompassed a range of skills, including freehand sketching,

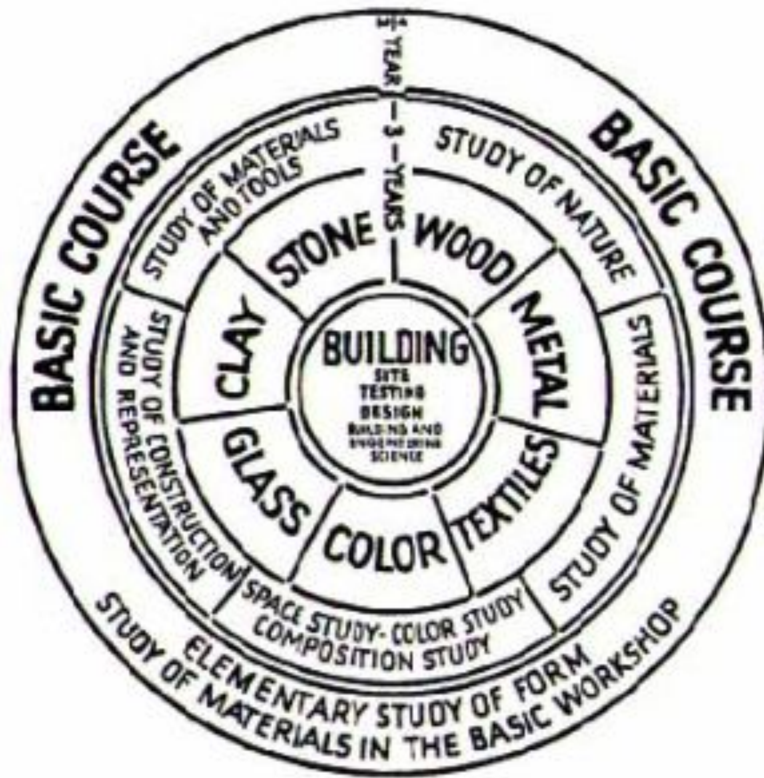


Figure 6: Bauhaus Course Structure (Pipes,2007)

landscape and still-life studies, composition, sketching from memory and imagination, and the design of practical articles such as furniture (Pipes, 2007).

Drawing at the Bauhaus was not directly tied to the design process initially. In the early years, the focus remained on developing craftsmanship, with workshops serving as spaces for prototyping and creating guides for industry craftspeople rather than producing traditional design drawings. This approach began to evolve in 1923 when László Moholy-Nagy shifted the workshops toward functioning as laboratories for innovating forms and norms suitable for mass production (Pipes,2007).

This transition signified a departure from traditional craft and aligned more closely with the industrial age’s demands. By 1925, Wassily Kandinsky introduced analytical drawing as an educational exercise in observation and representation. Rather

than focusing on the external appearance of objects, the aim was to uncover and depict their structural elements and underlying forces. Kandinsky's method emphasized clarity in observing and reproducing relationships as an entry point to understanding three-dimensional construction and design principles (Pipes, 2007).

Gropius envisioned an art and design education that integrated intellectual rigor, practical skills, commercial relevance, and aesthetic principles, thus responding to the demands of the modern industrial world. As Fiell and Fiell (2015) noted, "The goal of modern design, as pioneered and taught at the Bauhaus, was to produce work that unified intellectual, practical, commercial, and aesthetic concerns through artistic endeavor and the exploitation of new technologies" (p.6). Gropius' vision was radical for the time; he believed artists should not merely collaborate with craftspeople but be trained as craftspeople themselves. He aimed to dissolve the divide between the artist and the artisan, advocating for a philosophy of "learning by doing" and an aesthetic grounded in sound craftsmanship. This teaching style emphasized hands-on exploration, where students learned not only the theories of art and design but also the technical skills needed to produce work of lasting value and functionality, blending traditional techniques with modern technologies (Rice, 2023, para. 2).

Gropius' vision for the Bauhaus redefined modern aesthetics and radically transformed the educational approach to art and design, creating a foundation emphasizing experimentation and hands-on learning. Central to the Bauhaus program was the goal to free students from traditional artistic conventions and pre-existing biases, encouraging them to approach design with a fresh, open-minded perspective. Johannes Itten, one of the school's more influential instructors, developed a six-month

foundational course introducing students to various materials and techniques to promote exploration and understanding of material properties. Through practical, tactile experiments, students learned to accurately depict the textures, forms, and essences of different substances (Rice, 2023).

Initially, the Bauhaus placed little emphasis on machinery or industrial applications, focusing more on individual creativity and craftsmanship. However, as the program evolved, there was a deliberate shift toward preparing students for the realities of an industrialized society. By 1923, the Bauhaus began to pivot toward designing for mass production, reflecting Gropius' growing belief in the need for an architecture and design adapted to the machine age (Rice, 2023) This transition marked a move toward a more pragmatic, structured curriculum, equipping students with the skills and mindset to integrate functionality, aesthetics, and efficiency in their work for the modern world (Rice, 2023). By 1930, pressure from the "unstable political situation in Germany" culminated in a financial crisis, and the school moved its operations to Berlin. In 1933, the Bauhaus ultimately closed (Griffith Winton, 2007, para. 10).

The convergence of Gestalt psychology and Bauhaus teachings established a critical intellectual and methodological foundation for modern industrial design by reframing the understanding of form, perception, and making asconnected structures. Gestalt theory's emphasis on holistic perception and relational meaning, when translated through the Bauhaus curriculum, shifted design education away from purely representational or craft-based traditions toward a structured yet exploratory process grounded in visual cognition, material experimentation, and industrial applicability.

2.3 Sketch Psychology

2.3.1 The Mind's Eye

Concept generation and development are essential to achieving innovative design outcomes throughout the product design and development cycle. These stages allow designers to explore various creative ideas, which are the foundation for synthesizing the final solution (Atit et al., 2021).

Drawing and sketching become critical in bridging the mind's eye and realization. Sketches visually communicate concepts and act as repositories of design solutions, helping to identify conflicts, explore possibilities, and refine ideas. Milton Glaser is one of the United States' most prominent graphic designers, best known for his 1976 'I ♥ NY' graphic (Milton Glaser, 2019a). He commented on the utility of drawing in the design process, saying that drawing is not about representation but about thinking. Trying to understand what you're looking at … The brain sends a signal to the hand, and the hand sends one back, and there is an endless conversation between them. – Milton Glaser (Interviews, 2019b, para. 13).

Glaser was cited as believing that digital design lacks "fuzziness", and says the lack of precision in a sketch is a benefit rather than having to solidify an idea too early, "And so the essential part of the developmental dialectic disappears. The greatest liability to the computer is that a lot of weak ideas are very well developed. The computer clarifies things too quickly" (Milton Glaser, 2019b, para. 10).

Concept generation and development (particularly through drawing and sketching) function not merely as representational communications, but as iterative cognitive processes that externalize and evolve design thinking. Milton Glaser's (2019b)

perspective reinforced this by framing sketching as a feedback loop between mind and hand, in which ambiguity and imprecision become conduits for discovery rather than liabilities.

2.3.2 Visual Imagery

Visual imagery (a subcategory of mental imagery) typically enables individuals to "see absent items in the mind's eye," playing a role in memory, daydreaming, and creativity (p.246). It allows individuals to inspect these absent objects as though they were seeing them directly. This ability is harnessed in mental practice by teachers and trainers to enhance cognitive and creative skills. Visual imagery plays a significant role in creativity across both the sciences and the arts, acting as a valuable tool for problem-solving and concept generation (Zeman et al., 2020).

The concept of mental imagery originated in late nineteenth-century empirical psychology through the work of figures such as Francis Galton, Wilhelm Wundt, and Edward Titchener, before declining in prominence and later re-emerging in the 1970s as a legitimate area of scientific inquiry (Nanay, 2021). It is commonly defined as a perceptual representation that occurs independently of direct sensory input, with both early and contemporary perspectives emphasizing its phenomenological, “Phenomenology studies conscious experience as experienced from the subjective or first person point of view” and conscious qualities (Smith, 2013, para. 4).

2.3.3 Aphantasia and Hyperphantasia

The terms “aphantasia” and “hyperphantasia” were coined to describe the extremes of visual imagery vividness, which has led to increased public and scientific interest (Milton, 2021).

Data from Zeman et al.’s (2020) study involving 2000 participants with aphantasia and 200 with hyperphantasia reveal several critical differences between these two conditions. Aphantasia is more common among scientific and mathematical professions, while hyperphantasia is associated with creative fields. Individuals with aphantasia tend to report difficulties with face recognition and autobiographical memory, while those with hyperphantasia are more likely to experience synesthesia.

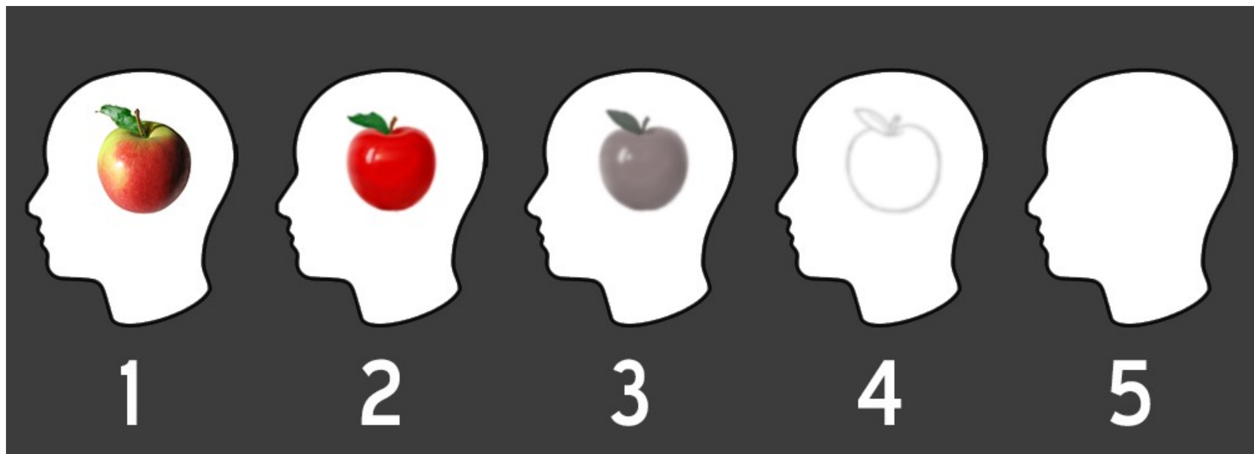


Figure 7: Scale of Visualization Ability Aphantasia Spectrum (2021)

Approximately half of those with aphantasia report the absence of imagery across all sense modalities while awake, although they typically experience visual dreams. Additionally, aphantasia appears to be hereditary, often running in families more frequently than expected by chance. Both aphantasia and hyperphantasia are widespread yet under-explored features of human experience with notable

psychological implications, especially concerning creativity, memory, and sensory experiences (Zeman et al., 2020).

2.3.4 Visual Literacy

Visual literacy has been an area of sustained academic inquiry since the 1960s, when John Debes and colleagues established the International Visual Literacy Association. Since that time, visual literacy has been examined across numerous disciplines, evolving into a multifaceted and interdisciplinary concept whose definition remains fluid and context-dependent. Contemporary understandings generally frame visual literacy as an individual's ability not only to analyze but also to produce visual materials (Hattwig et al., 2013).

Eva Brumberger emphasized that the most comprehensive definitions incorporate both interpretive and productive dimensions, arguing that analytical ability alone is insufficient without the capacity to create visual content (as cited in Hattwig et al., 2013). Further extending the concept, Tom Ipri introduces the idea of transliteracy, which highlights the interaction between textual, visual, and digital literacies rather than treating them as isolated competencies, while metaliteracy similarly underscores the connections among literacies and prioritizes higher-order thinking and collaborative knowledge production (Hattwig et al., 2013).

By examining perception as an interpretive rather than purely sensory process, George Nelson's How to See: A Guide to Reading Our Man-Made Environment (1977) critiques the assumption that seeing is an innate or universal skill. Nelson recounted an experiment in which audiences were shown a sequence of slides organized solely by

visual relationships, “associations of shape, use, pattern, color”, with no intended narrative structure. Nevertheless, four out of five groups interpreted the images as carrying moral or philosophical messages, asserting that the presentation “proved that natural objects were warm, friendly, beautiful… [while] man-made items were cold, hostile, inhuman,” or even that it communicated theological truths (p. 2). Nelson (1977) attributed these responses to a fundamental reliance on verbal or narrative frameworks: viewers unfamiliar with visual reasoning felt compelled to invent a story “just like on TV” to make sense of the images.

In contrast, a group of architecture students immediately recognized the visual logic at work, responding analytically and offering technical improvements. Their ability to “read” the slideshow visually demonstrated what Nelson (1977) identified as a ‘cultivated skill’ rather than an automatic faculty. He concluded, “...over 90 percent cannot see, except in the most primitive sense,” revealing a gap between looking and truly perceiving (p. 2).

This distinction is emphasized through the concept of visual literacy, which argues that, just as written literacy is essential to functioning within modern society, the ability to decode visual information is equally critical yet far less widely developed. “When we use the word ‘literacy’ we mean the ability to read, decode messages in a written language,” Nelson (1977) wrote, attaching “visual” therefore implies the ability to decode nonverbal messages as though a second language that these architecture students, and anyone exposed to the decoding process, had the experience to understand and communicate through (p. 4).

Nelson (1977) illustrated the daily interactions we have with visual literacy, from interpreting architectural cues about socioeconomic class to navigating traffic signals or reading gestures and expressions, and yet most people remain functionally untrained in understanding these systems. He noted that professions grounded in spatial reasoning, such as design and architecture, typically cultivate these competencies, whereas fields that privilege verbal logic (such as engineering, statistics, or finance) often do not.

The capacity to see is shaped not only by practice but by familiarity and prior knowledge. Nelson (1977) noted that individuals tend to "like what is familiar… and back off from anything unfamiliar," and that this resistance to new visual forms increases when education and exposure are limited (p. 5). Raymond Loewy, likely the "most widely known US industrial designer", termed this phenomenon as the MAYA Stage (IDSA, 2023, para. 1). MAYA, or Most Advanced Yet Acceptable, was coined to comment on the adult public's unwillingness to "…accept the logical solutions to their requirements if the solution implies too vast a departure from what they have been conditioned to accepting as the norm" (Loewy, 2023, p.326).

Lowey's and Nelson's reasoning demonstrates that perception is not neutral; it is conditioned. The visual environment of mass culture (whether in the automotive sector, furniture, or consumer technology) reinforces conservative taste, shaping preferences through repetition rather than engagement. Nelson (1977) argued that visual literacy, like traditional literacy, is constrained by the quality and breadth of one's stored information: just as the same radio transmission sounds radically different when received through a pocket transistor versus a high-fidelity system, the same visual experience varies profoundly depending on the viewer's perceptual literacy. The act of

perception, then, becomes a transaction between transmitter and receiver (between the image and the viewer), dependent on the viewer's capacity to interpret the visual code of what they perceive.

Figure 8: Apparition of Face and Fruit Dish on a Beach (Dali, 1938)

Figure 9: Windham Quin of Adare (Slaughter, 1745)

Visual literacy becomes especially relevant in the reception of modern art. Traditional representational painting allowed viewers to rely on subject identification (recognizing a dog or a landscape), requiring minimal visual literacy. Nelson (1977) observed that this made the experience of looking analogous to that of television narratives: comprehension depended on the story rather than on form, color, or structure.

While Nixon and Kruschev were having their kitchen debate, Nelson recounted for his readers an incident that occurred at the 1959 U.S. National Exhibition in Moscow:

> The Russians, long limited to an official style, not unlike that of the old Saturday evening post covers, jammed the gallery every day.
>
> One afternoon, a Soviet visitor, a man in his middle years, began asking questions of one of the guides about some of the far-out examples. The guide, a young American student, selected for her ability to speak Russian rather than for her knowledge of art, had trouble explaining what this or that picture meant and why the artist had painted it as he had. The visitor got impatient, then angry, and began shouting. “I demand an explanation of this rubbish! I am a Soviet citizen, I have a ticket to the exposition, and I have a right to know!” The rattle girl sent for help, but the noises got angrier and began to look as if a small riot were in the making. We were saved by another visitor, who tapped the enraged Soviet citizen on the

shoulder and said, “Comrade! Shut up. You are making us all look like fools.” The shouting stopped abruptly.

Our savior continued in a calm voice, but loud enough to carry through the room. “Comrade, the problem is not with these paintings, but with you. Through some misfortune in your upbringing, you were under the impression that a painting is a kind of window. You look through it and see a scene, like a bowl of apples or a bottle or a portrait. But that isn’t what a painting is at all. It is some pigment on a flat surface: maybe it shows something you can recognize, but it is also possible that all it shows you are shapes, lines, and colors.”

There was not a sound in the crowded room, and the stranger continued. “Imagine, my friend, that this is not a painting gallery, but a display of important mathematical equations. Would you then start shouting at this nice young woman and get her upset by demanding that she explain these to you? Of course you wouldn’t. You would realize that you don’t understand mathematics, and keep quiet, here we have paintings, and you don’t understand them either. Why don’t you just look at them without disturbing everyone, and then, when you go home, perhaps you can find some books that might help you begin to learn something about art. Try to remember that the rest of us here are also Soviet citizens and that your

> uncultured behavior is giving our American guest. Hear a very bad impression."
>
> He drifted off into the silent room, carefully looked at each picture, and presently vanished. The moral, I suppose, is that the USSR has its full share of visual illiteracy too, but his point could not have been made with greater force or clarity: a painting is not a picture window: it is a painting. (Nelson, 1977, p. 6-7)

Nelson (1977) concluded this portion with a quote from Dr. Joshua Taylor of the National Gallery: "To see, is to think. To think is to put together random bits of private experience in an orderly fashion. Seeing is not a unique God-given talent, but a discipline. It can be learned" (p.7). Seeing becomes a cognitive operation grounded in intentionality, interpretation, and accumulated knowledge. Perception is not a primitive sensory reaction but an intellectual process: an act of assembling, analyzing, and synthesizing visual information. This perception becomes greatly influenced by the cultural background of the individual and their exposures to certain stimuli. Nelson (1977) builds this case with the excerpt above.

Following the National Exhibition, the Soviet artistic response culminated in a 1962 exhibition at the Manezh Hall adjacent to the Kremlin. The exhibition, which featured non-realist and abstract works, was publicly denounced by Nikita Khrushchev:

> Premier Khrushchev inspected today one of the first exhibitions of Soviet abstract paintings and rejected the works as ‘foreign to our people.’ He personally scolded the assembled artists for breaking away from ideologically approved socialist realism. The Soviet leader thus apparently signaled the repression of a brief upsurge of freedom in the fields of Soviet painting and sculpture. Asserting that the Soviet people rejected abstractionism, Mr. Khrushchev told the painters: “This must be pondered on by people who call themselves artists and create such pictures that you cannot tell if they have been painted by men or have been daubed by the tail of a donkey (Topping Special, 1962).

and subsequently shut down, forcing many artists further underground (Simms, 2007). Non-representational art was condemned as a “bourgeois deviation,” and exhibitions were routinely closed within hours of opening by state authorities, reinforcing a cultural framework that privileged narrative clarity and ideological legibility over visual experimentation.

Abstract Expressionism came to the forefront of the art world as a direct rejection of traditional artistic conventions that had dominated the art world before World War II. Artists associated with this movement dismissed realist styles as susceptible to propagandistic use and resisted the rational, analytic principles of geometric abstraction. Despite notable differences between European and American postwar practices, ideologies, and sociopolitical conditions, their work shared a commitment to the gestural mark as a vehicle for intense expressive content and an emphasis on the

physical act of painting as a manifestation of artistic free will. In this context, modernist works challenge viewers to move beyond mere recognition toward interpretation, demanding active engagement with visual language itself. (Mildred Lane Kemper Museum, 2020)

Artists working within Abstract Expressionism, such as Jackson Pollock and Mark Rothko, intentionally moved away from representational form toward non-objective compositions in an effort to convey emotion, spirituality, and the unconscious. Rather than depicting recognizable subjects, these artists sought to communicate experiences that resisted verbalization, relying on visual structure and material presence to evoke meaning (Simms, 2007). Each artist approached this shift differently, yet collectively their work demonstrated that visual communication need not depend on narrative or symbolic depiction to be effective.

As these Abstract Expressionist works circulated internationally throughout the late 1950s (including exhibitions across Europe and the Moscow exhibition of 1959), they presented an alternative visual logic that challenged audiences to reconsider how meaning is constructed. Judith Barter, Field-McCormick chair and curator of American Art at the Art Institute of Chicago, noted that abstraction often acquires meaning through viewer interpretation rather than prescribed content, allowing for multiple readings shaped by individual perception and experience (Simms, 2007).

Abstract works tended to be more easily adopted and experimented with outside of the 1959 Moscow exhibition. Killian (2021) discussed these examples, going over Jackson Pollock and Willem De Kooning’s (as well as other abstract artists’) travels to France for education post-WWII “More than 400 artists…” leveraged the G.I. Bill to

enroll in and finance their studies in Parisian art programs "…between 1944 and 1953". The desire to study in Europe, particularly France, was varied from "…the cultural appeal of Paris, its museums and its masters, the draw of Europe, the possibility of creating without any real constraints through grants, the search for greater freedom, the desire to be elsewhere, to be in Paris as if on an island" (Killian, 2021, para. 2)

The differences in cultural climate around the rise of abstract expressionism were chosen to exhibit the impacts that cultural beliefs and lived experiences have on an individual's ability to interpret and interact with a new stimulus, in this case, art. The culmination of these traits is stored as a schema and directly impacts the viewer.

2.4 Lived Experience

2.4.1 Schema

Perception is not a passive recording of visual information but an active, interpretive process shaped by prior knowledge, cultural context, and cognitive structure. Cultural schema theory describes how individuals organize perceptions of themselves, others, and the world through learned mental frameworks that operate both individually and collectively (Shahghasemi, 2017). These schemas function as filters, determining what is recognized as familiar, desirable, or meaningful before conscious judgment occurs.

Across disciplines (philosophy, psychology, anthropology, and cognitive science), scholars have emphasized that human understanding is constructed through classification and categorization. Cognition operates by matching new sensory input

against existing categories stored in memory, a process neurologists refer to as category activation (Shahghasemi, 2017). When encountering a new object, image, or environment, the mind searches for resemblance to known forms, integrating the unfamiliar into established structures whenever possible. This mechanism allows for rapid recognition and decision-making, but it also reinforces habitual ways of seeing.

Because categorization happens continuously and often unconsciously, aesthetic judgment is frequently mistaken for intuition or personal taste. In reality, preferences are shaped by a combination of biological responses, cultural conditioning, and accumulated experience. Psychological research on aesthetics demonstrates that elements such as color, composition, and contrast elicit emotional responses that feel immediate but are deeply learned (Amador, 2024). Warm hues are commonly associated with energy and intimacy, while cool tones are linked to calm and stability; monochromatic or neutral palettes are often perceived as refined or timeless. These associations, however, are not universal. Cultural context significantly alters meaning (white may signify purity in one culture and mourning in another), illustrating that visual interpretation is contingent rather than fixed (Amador, 2024).

Art history courses play a critical role in building schema. Beyond appreciation, the study of art provides insight into how visual languages evolve in response to social, political, and technological conditions (Bardon, 2023). Historical movements reveal how values and belief systems are encoded in form, material, and composition, and how once-radical visual strategies become normalized through repetition and exposure. What begins as unfamiliar or disruptive may, over time, becomes mainstream, reshaping collective aesthetic standards (Amador, 2024).

This gradual normalization of innovative art highlights a central challenge for design education: without deliberate intervention, students often default to familiar visual schemas reinforced by market trends, media saturation, and prior exposure. Visual literacy, therefore, is not simply the ability to recognize images but the capacity to deconstruct them (to identify the cultural, psychological, and formal systems at work, and to consciously recombine or resist them). As Bardon (2023) argued, understanding visual culture equips individuals to recognize patterns of power, resistance, and innovation embedded in creative expression.

Developing visual literacy requires both exposure and practice. When students are trained to analyze unfamiliar forms, question their aesthetic responses, and experiment outside dominant visual conventions, they begin to expand their perceptual repertoire. This process destabilizes automatic categorization and opens space for alternative interpretations. In this sense, visual literacy functions as a learned discipline rather than an innate talent, one that enables designers not only to see more clearly but to design more intentionally (Nelson, 1977).

Nelson (1977) touched on the idea of schema and the reader's "…accumulated experiences, stored information, private interests, and entrenched beliefs" as drivers of visual literacy (p. 10-11). Most importantly, he assumed that "if the reader has an interest in sharpening [their] visual skills …it doesn't matter where [they] start" (p. 10). He also explained seeing as something which could not

> …be disconnected from the overall workings of the brain, [it] relates to the traditions which we have been raised— ideas embedded in childhood, the million

bits of random information stored in our private memory banks, either conscious or subconscious— to the rigidity or flexibility with which we respond to the familiar or, better still, to the familiar when seen with fresh eyes. The seeing is always conditioned, yet it is uniquely personal and private (p. 11).

As articulated by George Nelson (1977), what individuals see is inseparable from their accumulated experiences, cultural conditioning, and mental models, meaning that visual interpretation is both deeply personal and systematically conditioned. This reinforces the idea that aesthetic judgment, preference, and recognition are not purely intuitive acts but the result of learned categorizations that shape how new information is processed and understood.

2.5 K-12 Education

2.5.1 The Structural Suppression of Design Thinking in K–12 Education

Design thinking requires visual literacy, systems thinking, creative risk-taking, and productive engagement with failure. However, scholarship across art education, organizational theory, and assessment research suggests that contemporary K–12 schooling systematically deprioritizes (and in some cases actively suppresses) these very capacities.

Nelson (1977) argued, “seeing is also dependent on the value system of the observer” (p.9). Visual literacy is not merely perceptual; it is culturally conditioned and institutionally reinforced. If educational systems prioritize textual and quantifiable

competencies over visual and interpretive ones, students internalize those hierarchies. Nelson further contended that young children "…all of whom quite naturally absorb great quantities of visual information" (p. 9). Visual capability is "beaten out of them by the educational process" (Nelson, 1977, p. 9).

Nelson (1977) continued by dismissing the idea that visual illiteracy stems from insufficient schooling. Modern societies invest heavily in educational infrastructure; the issue lies in the kind of education being delivered. He suggested that technologically driven societies increasingly remove individuals from processes of making and decision-making, rendering them passive operators rather than engaged creators, directly critiquing schooling models that emphasize efficiency, automation, and standardized outcomes over exploratory or generative inquiry.

2.5.2 Standardized Testing and the Narrowing of Curriculum

In their study of North Carolina's ABCs accountability program, Jones et al. (1999) found dramatic increases in time spent on tested subjects (reading, writing, and mathematics) while arts instruction received substantially less attention, indicating these "opportunities have largely been in steady decline in the U.S. from the 1980s through 2000s" with the "…advent of No Child Left Behind. From 1999-2000 to 2007-08, there was a 4% decline in music courses offered and a 1% decline in visual art courses" (Arts, Humanities, & Civic Engagement Lab, 2018, para. 1). Teachers reported that assessment "drives instruction," with curriculum narrowing occurring as they focused on

discrete skills likely to appear on standardized tests. Higher-order thinking and problem-solving were frequently marginalized because such skills are more difficult to measure.

Standardized tests typically privilege discrete, easily quantifiable knowledge over analysis, synthesis, and creative problem-solving (Jones et al., 1999). Design thinking, by contrast, relies on ambiguity tolerance, iterative exploration, and the synthesis of heterogeneous inputs (modes of cognition poorly aligned with standardized testing frameworks).

Contemporary advocacy organizations echo these concerns. The National Art Education Association (2025) emphasizes that high-quality visual arts and design education requires uninterrupted, sequential learning experiences that include creation, reflection, presentation, and assessment. These processes cultivate creativity, higher-order thinking, and problem-solving, core competencies essential for both design practice and broader college and career readiness.

Similarly, the American Academy of Arts and Sciences (2021) warns that high-stakes testing can undermine holistic education by reducing access to arts instruction. When instructional time is diverted away from visual arts through pull-outs or curricular compression, students lose exposure to structured creative inquiry—an essential foundation for design thinking.

2.5.3 Arts Education, Cognitive Development, and Equity

Research demonstrates that arts education produces measurable cognitive and socio-emotional benefits. Studies summarized by the AAAS (2021) show causal links between arts engagement and “arts education and critical thinking outcomes, increased tolerance, increased empathy, and higher motivation to engage with arts and culture” (p. 4). Compounding on this, children of college-educated parents are six times more likely to receive arts education than children whose parents did not complete high school (AAAS, 2021). Thus, when K–12 systems reduce arts exposure, they disproportionately affect already marginalized populations, furthering inequities in access to creativity-driven career pathways such as design.

2.5.4 Failure, Risk, and Organizational Culture

Design thinking is iterative and failure-dependent. Yet multiple scholars note that institutions (including schools) are structurally biased against failure. McGrath (2011) argues that most organizations avoid studying failure systematically; instead, errors become “undiscussable,” discouraging risk-taking and experimentation (para. 1). When individuals fear reputational harm, they retreat into safe, predictable behaviors.

This occurrence finds parallels in classroom environments shaped by high-stakes, standardized evaluation. If grades and test scores are primary performance indicators, students are incentivized to minimize error rather than explore uncertain possibilities.

Research in STEM education reinforces this point. Although failure is integral to the scientific method, it is not typically taught as a productive process (Nunes et al., 2022). Students are rarely trained to engage constructively with failure, despite its centrality to authentic inquiry. Design processes operate similarly: ideation, prototyping, and iteration rely on cycles of testing and revision.

Arrington et al. (2021) argued that learning from failure, systems thinking, and creativity are mutually reinforcing competencies. Cultivating one strengthens the others. A mindset that reframes failure as diagnostic rather than punitive allows individuals to analyze contributing factors systemically and generate innovative responses. Moreover, failure can enhance long-term motivation when effort is reinforced. However, novices require structured support to recognize and leverage this developmental potential.

K–12 environments dominated by summative assessment rarely provide the scaffolding that research has shown to be integral to design thinking. Instead, failure is often final, recorded, and consequential, ultimately discouraging experimentation and suppressing creative risk-taking, a habit students sustain in college classes.

2.6 Semantics

Product semantics examines how designed objects communicate meaning through their form within contexts of use. It extends beyond purely functional and physiological considerations to include psychological, social, and cultural dimensions—collectively understood as the product's symbolic environment. Emerging from developments in design theory associated with the Ulm School, product semantics

reframes design as a communicative act in which objects convey cognitive meanings, symbolic functions, and cultural narratives (Krippendorff & Reinhart, 1984).

Within this framework, designers operate as communicators, constructing meaning through a vocabulary of form (shape, color, texture, and material) organized into coherent messages. These messages are interpreted by users based on prior experience, expectations, and context. Consequently, products are not neutral artifacts; they signal information about their function, usability, and the identity or values of their users. (Krippendorff & Reinhart, 1984).

Products operate simultaneously across multiple layers of function: technical, practical, and semantic. While technical and practical functions address performance and usability, the semantic dimension governs how a product is understood and experienced. Monö Wikström (1996) coined four modes of semantics: describing, expressing, identifying, and signaling, described here.

- **To describe:** the product gestalt communicates factual information, such as its purpose, mode of use, and handling.
- **To express:** the product conveys values and qualitative attributes that shape perceptions of character, quality, and desirability.
- **To identify:** the product situates itself within a broader context, indicating origin, product category, system relationships, and the organization of its components.
- **To signal (or make evident):** the product clarifies how it should be interpreted or engaged with, reinforcing recognition and usability through perceptual cues.

Contemporary expectations further reinforce the importance of this semantic layer. Functional performance, usability, and safety are now assumed as baseline attributes, while increasing emphasis is placed on a product's ability to evoke emotion, inspire users, and enrich everyday experience (Demirbilek & Sener, 2003).

2.6.1 The Semantic differential

The semantic differential (SD), developed by psychologist Charles E. Osgood, is a measurement technique used to assess the connotative meaning of concepts, including objects, ideas, and experiences. It captures both affective and cognitive responses by asking participants to rate a concept along a series of bipolar adjective scales (e.g., good–bad, strong–weak, active–passive). These scales are typically structured as seven-point intervals with a neutral midpoint, allowing for gradation in perception (Ploder & Eder, 2015; Tullis & Albert, 2013).

Unlike conventional rating methods, the semantic differential is highly versatile, enabling the measurement of associations, emotions, attitudes, and motivations across a wide range of contexts. Through factor analysis, Osgood identified three primary dimensions that consistently underlie these evaluations:

✦ **Evaluation** (value judgment)

✦ **Potency** (perceived strength or power)

✦ **Activity** (perceived dynamism or energy).

The semantic differential provides a structured yet flexible framework for quantifying subjective perceptions, making it particularly useful in design research for assessing how users interpret and emotionally respond to products.

2.6.2 Visual Literacy in the Future

In Design as Art, Bruno Munari (2008) notes that just as languages become obsolete, so too do visual modes of expression. Communication relies not only on words but on images, forms, colors, signs, and symbols (each embedded within a cultural and temporal framework). Munari's example, the blacksmith's sign, once vivid with meaning and sensory association for children in 1900, now registers as inert or obscure. Visual signs, like verbal ones, are not inherently stable; they depend on shared cultural literacy. When that literacy dissolves, meaning collapses or mutates.

The necessity of visual literacy becomes especially evident when communication must extend beyond shared language, culture, or even historical continuity, an issue confronted directly in the development of nuclear semiotics. In 1981, an interdisciplinary team including Thomas Sebeok, Paul Ekman, and Percy Tannenbaum was convened by the U.S. Department of Energy as part of the Human Interference Task Force (Office of Nuclear Waste Isolation, 1984). Their charge was existential rather than aesthetic: to design warning systems capable of communicating the danger of radioactive waste repositories to humans thousands of years in the future.

The task force recognized a critical semiotic dilemma. While radioactive waste could be physically isolated in geological formations, isolating future humans from it required something far more complex: a communicative system resilient to linguistic

drift, symbolic evolution, and cultural transformation. Because future societies' languages, belief systems, and technological capacities could not be predicted, the group concluded that reducing accidental intrusion would depend on creating warnings that could convey danger over deep time (Office of Nuclear Waste Isolation, 1984).

Three mechanisms for reducing human interference were identified: minimizing incentives for intrusion, increasing the physical difficulty of access, and communicating danger to future generations. The task force ultimately focused on the third mechanism, acknowledging that communication (rather than barriers alone) was the most uncertain and critical variable (Office of Nuclear Waste Isolation, 1984). This decision implicitly recognized that visual communication, not written language, would bear the burden of meaning when all other systems failed.

Subsequent discussions and proposals revealed how fragile conventional symbol systems become when removed from cultural context. As Chapman (2022) noted, early solutions emphasized redundancy: multiple warning layers, monumentality, and physical isolation from human settlements or valuable resources. Massive stone structures, asphalt-sealed markers, and central monuments resembling modern-day Stonehenge were proposed to endure natural weathering for millennia. Yet even these designs failed to address the central question: how does one communicate danger to an unknown future audience?

As the problem persisted into the late twentieth and early twenty-first centuries, institutions such as Sandia National Laboratories revisited the issue while planning surface markers for the Waste Isolation Pilot Plant in New Mexico. Designers explored the use of what they described as a physical language—forms intended to provoke fear,

unease, or repulsion rather than understanding. Proposals included jagged granite spikes and vast, dark slabs meant to intimidate through scale, material, and spatial aggression (Chapman, 2022). These designs relied not on symbolic literacy but on visceral human perception.

The final solution combined monumental architecture with multilingual inscriptions, embedding warnings within an environment designed to feel hostile rather than informative. Thirty-two granite pillars, an enclosing earthen wall, and a central chamber containing warnings in multiple languages were intended to communicate a simple message: this place is dangerous, and it should not be disturbed (Chapman, 2022). Even then, the designers acknowledged that language would inevitably fail, and that meaning would ultimately be inferred through form, scale, and affect.

Visual literacy is not limited to interpreting images within a known cultural framework. It is the ability to read, construct, and respond to visual systems when language collapses, when narrative is absent, and when meaning must be inferred rather than explained. Nuclear semiotics reveals that form, gesture, material, and spatial composition function as communicative tools independent of representation, an insight that directly parallels the role of abstraction, gesture drawing, and non-narrative sketching within design education.

2.7 The Camera

2.7.1 History of the Photograph

The association between photography and objectivity is deeply rooted in the medium's technical origins. Long before photographs could be fixed permanently, the optical principles underlying the camera were already well understood. Devices such as the camera obscura, documented as early as the fifth century BCE, demonstrated the ability of light passing through a small aperture to project an inverted image of the external world onto a flat surface (Lee, 2022). These early mechanisms positioned the camera not as a tool of interpretation, but as a neutral conduit between reality and representation.

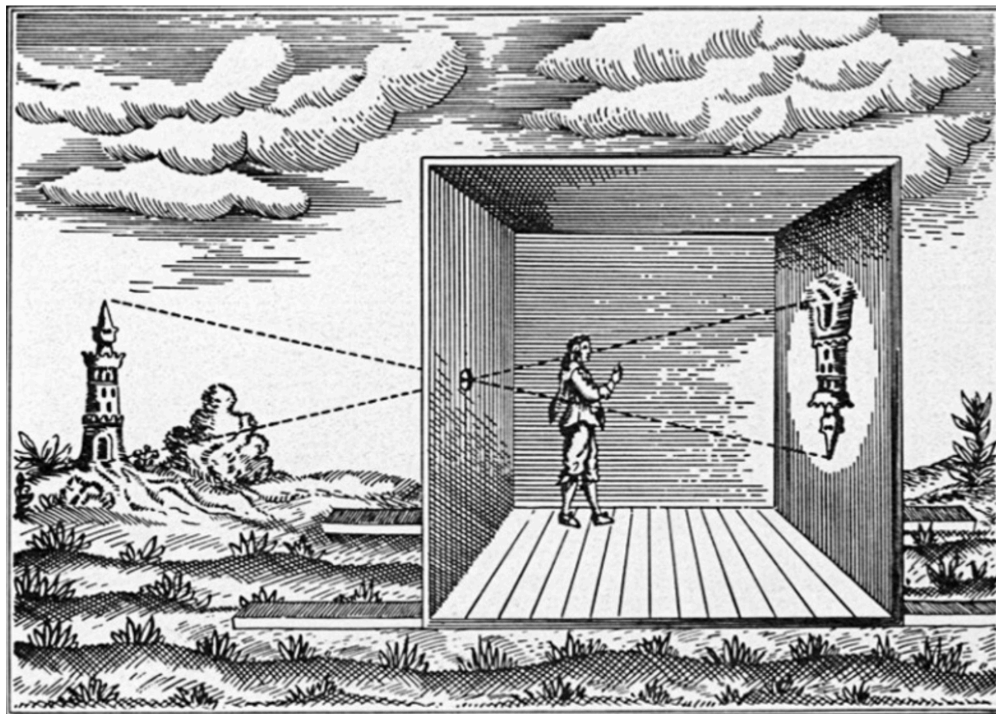


Figure 10: Camera Obscura
(Photoion Photography School, 2014)

The critical limitation of these early systems was impermanence. Images produced by camera obscura devices were fleeting, and early attempts to chemically fix them degraded rapidly. It was not until the early nineteenth century that Joseph

Nicéphore Niépce and Louis Daguerre developed practical techniques for permanently capturing images, with Niépce producing the first surviving photograph in 1827 and Daguerre popularizing the daguerreotype shortly thereafter (Lee, 2022). “Niépce’s process involved applying a varnish of bitumen to a copper or tin plate, making an exposure, rinsing the plate in diluted lavender oil to dissolve the unexposed bitumen, and dipping the plate in an acid bath to react with the exposed areas. Multiple prints could then be made from the resulting plate” (Rice, 2019, para. 7). The images carried an unprecedented authority: they appeared to be direct imprints of reality itself.

Figure 11: Nicéphore Niépce, View from the Window at Le Gras, heliograph, 1826 (Rice, 2019)

This authority was amplified by photography’s rapid democratization. Daguerreotypes provided middle-class Europeans with affordable portraiture, and

subsequent technical developments (glass plate negatives, mass reproduction, and roll film) further distanced photography from the labor and subjectivity associated with painting (Lee, 2022). By the turn of the twentieth century, cameras such as Kodak's Brownie had transformed photography into a ubiquitous tool for documentation, reinforcing the perception that photographs simply showed rather than interpreted.

2.7.2 The Objective, the Subjective

Throughout the twentieth century, photographic technology continued to evolve at an accelerating pace: 35mm cameras, photograms, strobe photography, color film, and instant photography expanded both the technical and expressive capacities of the medium (Lee, 2022). Yet despite these advances, photography remained largely excluded from institutional definitions of fine art. As Grundberg (2021) noted, mid-century museums, academic departments, and art-history surveys largely ignored photography, relegating it to journalism, commercial use, or informal exhibition spaces. Even within universities, photography was often treated as a technical or utilitarian skill rather than an artistic or interpretive one.

This marginalization was not accidental. Photography's perceived objectivity made it difficult to reconcile with dominant modernist narratives that privileged abstraction, authorship, and expressive subjectivity. Ironically, these same qualities later facilitated photography's entry into contemporary art. Grundberg (2021) argued that photography's rise from the margins to the center of the art world reshaped contemporary practice, broadening art's engagement with representation and mass culture

The tension between objectivity and subjectivity remains central to photography's role today. On one hand, photography continues to function as an instrument of visual control and classification. In industrial contexts, visual inspection (whether automated or manual) remains critical for sorting, quality assurance, and decision-making, reinforcing photography's status as a tool for neutral observation (Hryb & Rudzki, 2024).

On the other hand, photography plays a powerful role in shaping perception and desire. Research in consumer behavior shows that the presence of visual art (even when unrelated to a product's function) can significantly alter how the product is perceived. Hagtvedt and Patrick (2008) showed that associations with visual art transfer connotations of luxury to consumer goods, influencing evaluation regardless of the artwork's specific content. In this sense, photography and visual imagery operate not as records of reality but as mechanisms of persuasion.

Ansel Adams, one of the most celebrated photographers in United States history known for capturing the remaining expanses of untouched wilderness, particularly within national parks and protected lands, commented on this dual nature of photography in an interview at, and later published by, the University of California, Berkeley, in 1978 (Adams et al., 1978; Szarkowski, 2018). The relevant portion of the interview is reported here:

Teiser: I was looking at Helen Le Conte's copies of the Sierra Club Bulletin. At your earliest photographs and those of a variety of other people, and the distinction between why you were taking them and why they were taking them is apparent.

Adams: Well, it's a different point of view. But you see, that's the meaning of "photography is a language." Take the English language, and you can use it for classified ads and scientific papers and news reporting and poems and essays, all forms using the same language. So when you say Joe Le Conte's pictures aren't any good because they're not creative, you are wrong. What you mean is that they don't stir you emotionally and aesthetically, but that wasn't their function. Their great importance is as records.

One of the great problems we have in our Friends of Photography: our charter reads that we are to further creative photography. Well now somebody comes in who's been over to Africa, and they've got a lot of pictures of wildlife, and he thinks they're just something wonderful, and he's a member, and he wants to show his pictures. Sometimes you can tell him why you can't show them but other times you can't. Some people just simply can't understand. They never go beyond the subject. Here they have an elephant, and it's a fairly good shot of an elephant. But you know, you say, "Well, that's an elephant" [laughs], but period! And a lot of people just have no idea what you're talking about when you try to explain that you see it at a very low level of imagination and a high level of factual information. (Adams et al., 1978, p.66)

2.8 Sketching for Design Thinking

Most people, including most designers, draw intuitively, often unconsciously, informed by art history. Designers rely on “by eye” techniques, much like how a self-taught musician plays “by ear” (Pipes, 2007, p.44). Early formal drawing education in schools or colleges typically includes life drawing, learning to analyze still-life compositions by breaking down objects into geometric forms, and mastering the rules of perspective. These rules often involve drawing rows of telegraph poles or trees diminishing into the distance, joined by converging lines that meet at a theoretical vanishing point (Pipes, 2007).

Figure 12: Museum Art School (later PNCA), still life, circa 1942-1947
(Japanese American Museum of Oregon, n.d.)

At the initial concept stage of the design process, sketches are primarily for the designer's use, capturing fleeting ideas without concern for formal representation. The main objective is to record these ideas before they are lost. However, sketches evolve as the design process progresses, communicating refined concepts to clients or

collaborators. At this point, drawings must transition to a more realistic style, capable of conveying intricate details clearly and precisely to manufacturers. This requires adherence to established conventions, ensuring the drawings are comprehensive and unambiguous (Pipes, 2007).

The role of the product designer's drawing is to represent a conceptual three-dimensional object through marks on two-dimensional paper or digital screens. These drawings must accurately reflect the intended design for effective communication with team members and manufacturers. Early-stage pictorial sketches, while sufficient for initial ideation, give way to orthographic projections (comprising plans and elevations) as the conventional means of conveying form and geometry during production (Pipes, 2007). However, for more complex 3D details, auxiliary views are often necessary to provide additional clarity.

Despite their precision, orthographic drawings can be challenging for non-specialists to interpret. To address this, designers frequently employ 3D perspective drawings when presenting proposals to clients or managers. Perspectives are so deeply ingrained in the collective visual consciousness that most designers can produce them almost unconsciously. Additionally, non-perspective projections, such as isometric and axonometric views, are increasingly popular among designers across various disciplines for their clarity and practicality (Pipes, 2007).

Sketching remains a cornerstone of industrial design, serving as a vital communication tool and an integral part of the design thinking process. Designers visualize, iterate, and refine ideas through sketching, with each sketch marking a step in

their exploration. This iterative process is essential in addressing what Emerson (1957) called the "…answer to the question of how to design" (p. xi).

A foundational element in industrial design education is teaching students to master the fundamental geometric forms: "the line, the plane, the circle, the cylinder, the cone, and the sphere" (Pipes, 2007, p. 37).

This geometric approach, rooted in the 19th-century practices of engineer James Nasmyth, emerged from the practical challenges of precision machining and the effort to align aesthetics with advancing technology (Pipes, 2007). This strategy of breaking down objects into fundamental shapes remains central to modern industrial design sketching.

However, this geometric style has faced opposition, notably from John Ruskin, who championed naturalistic drawing as part of his advocacy for "honest craftsmanship" during the industrial era. Ruskin criticized the "savagery of geometric drawing" and promoted drawing approaches emphasizing tonal variation and impressionistic qualities (Obniski, 2008; Pipes, 2007, p.37).

2.9 Applications

The early 20th century saw the painter emerge as a pivotal form-giver, particularly in movements like De Stijl. In this movement, abstract painting was considered a demonstration of universal laws of form, where compositions stripped to fundamental shapes and colors symbolized clarity and purity. Art Deco, characterized by its angular and often cold forms, was a response to "… a society grappling with loss, austerity, and the erosion of pre-war ideals" (JD Institute of Fashion Technology, 2024, para. 1). Artists and designers were positioned uniquely to redesign the world after the

Great War (1914-1917). Rethinking design was necessary because “The war triggered a significant shift in the availability of materials and resources. Metals were redirected towards the war effort, leading to a scarcity of iron, steel, and brass, which were commonly used in furniture, lighting, and decorative elements… Simpler, more utilitarian designs became the norm, prioritizing functionality over ornamentation” (JD Institute of Fashion Technology, 2024, para. 3).

Returning from the First World War was marked as a tumultuous time in world history as those who had seen battle returned to homes that now no longer felt like “[s]anctuary. The destruction and disillusionment caused by World War I led to a rejection of pre-war ideals” that sought to move away from Victorian and Edwardian interiors in favor of “Modernist architects and designers, such as Le Corbusier and Walter Gropius, envisioned the home as a machine for living, designed for efficiency and practicality” (JD Institute of Fashion Technology, 2024, para. 1). Walter Gropius held a belief in the transformative potential of artistic vision, hoping that the painter’s skills could seamlessly integrate into industrial production.

Gropius later acknowledged the inherent differences between art and industrial design. In 1926, he wrote, “The forms of industrial products, in contrast to the forms of art, are super-individual, and they come about as the result of an objective investigation into a problem. The limits of technology are determined by reality, but art can only attain heights if it sets its aims in the realm of the ideal” (Pipes, 2007, p. 39).

Throughout much of the 20th century, drawing received scant attention within design discourse. While necessary, it was often viewed as a utilitarian component of the design process rather than as an intellectual or creative driver. Modernism, with its

mantra of form ever follows function, championed by figures like American architect Louis Sullivan, shifted the focus of design education and practice toward systematic problem-solving. This approach prioritized functional and technological concerns over the expressive and experimental aspects of drawing (Pipes, 2007).

During this period, designers’ drawings became unseen, an ever-present but unacknowledged part of the process. Their sketches and explorations were often relegated to private stages of development, deemed too intuitive and informal to play a prominent role in public-facing design narratives (Pipes, 2007). The undervaluing of drawing coincided with a broader trend in which design was seen as a methodical problem-solving discipline, with emphasis on final products rather than the creative processes that led to their realization.

2.10 Materials

2.10.1 Newsprint in Art

Early machines, such as the moving-wire and cylinder-wire systems, allowed paper to be produced continuously rather than sheet by sheet. These innovations fundamentally altered the relationship between artists, designers, and their materials. The cylinder-wire machine, in particular, relied on suction and rotary motion to draw pulp from a vat, producing long, continuous paper webs that could be pressed and rolled into unprecedented lengths (Valente, 2012). The result was not only increased efficiency, but a new class of papers optimized for speed, volume, and disposability rather than archival permanence.

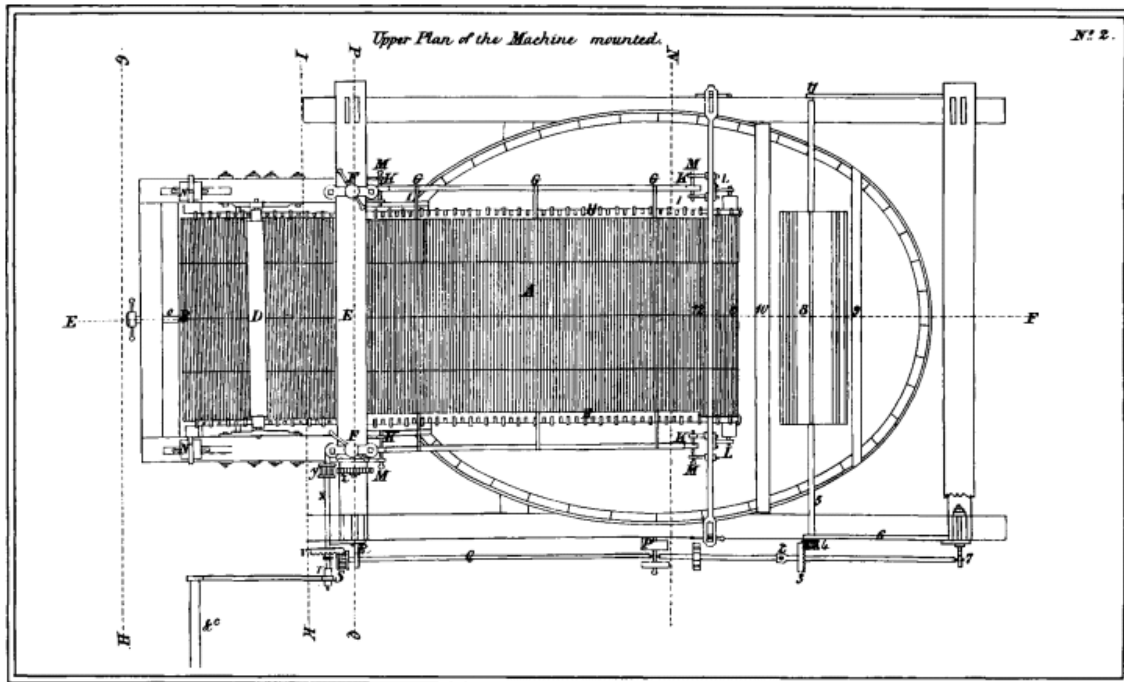


Figure 13: First paper-making machine, patent
(Louis Robert - an overview | ScienceDirect Topics, 1967)

Cheap, mechanically produced papers (particularly newsprint) became central to twentieth-century artistic and design practices. Newsprint's thinness, low cost, and lack of archival durability positioned it as a working surface rather than a precious one (Media, 2006).

Within contemporary art and design education, newsprint remains a preferred surface for gestural and exploratory drawing. Its smooth surface allows dry media such as charcoal, pencil, and pastel to glide easily, encouraging broad arm movement and rapid mark-making rather than tight control (Art Supply Guide, 2015). This physical interaction reinforces a mode of thinking that favors ideation over refinement. Mistakes are inexpensive, revision is expected, and accumulation replaces precision as the primary strategy.

2.10.2 Charcoal for Sketch

Charcoal, particularly vine or willow charcoal, complements these material qualities. Unlike pencils or pens, charcoal resists absolute control. Its softness, fragility, and responsiveness to pressure produce marks that are variable, broken, and easily altered. Artists frequently describe charcoal as a medium that foregrounds movement, gesture, and energy rather than contour accuracy or detail (Picard, 2022).

Monochrome charcoal studies further remove the distraction of color, forcing attention toward form, proportion, weight, and flow. As Picard (2022) noted, working at larger scales encourages whole-body engagement, allowing lines to originate from the shoulder and torso rather than the wrist. This embodied approach aligns directly with gesture drawing's emphasis on capturing essence rather than likeness. The occasional introduction of black or white chalk or hard pastel for contrast enhances legibility without sacrificing immediacy.

Figure 14: Charcoal Gestures, body in motion (Happy Pottery Barn, 2024)

The two of them together, newsprint and charcoal, form a material system that actively supports exploratory thinking. Their impermanence discourages preciousness; their physical resistance encourages adaptation; and their historical association with mass production and iteration positions them as tools for process rather than presentation. In the context of this study, these materials are not chosen for nostalgia or tradition, but for their capacity to externalize thinking, tolerate failure, and facilitate visual deconstruction during early-stage ideation.

2.11 Design Thinking Frameworks

2.11.1 IDEO: The 3-Stage Design Thinking Process

IDEO (n.d.) was founded in 1991 by David Kelley, Bill Moggridge, and Mike Nuttall with the aim to help "…organizations innovate by combining human-centered design, systems thinking, and creative experimentation to unlock new sources of value" (para. 2)

Design thinking is rooted in openness and curiosity, described by IDEO (n.d.) as adopting a "beginner's mind," in which assumptions are set aside, and ambiguity is embraced (para. 9).

The process is typically divided into three phases: inspiration, ideation, and implementation (Balcaitis, 2019).

✦ **Inspiration:** Focuses on observing people and gathering insights to better understand their needs and experiences.

✦ **Ideation:** Ideas are generated and explored, often through collaboration within diverse teams to encourage creativity.

✦ **Implementation:** Turns ideas into prototypes and real solutions, which are tested and refined before being presented or launched (Balcaitis, 2019).

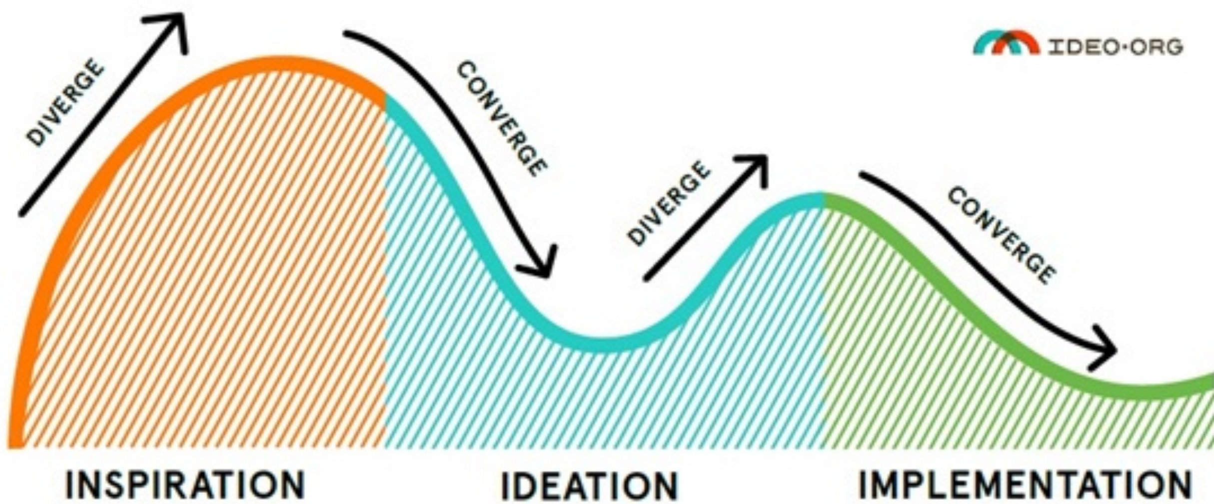


Figure 15: The 3 core activities of Design Thinking (Balcaitis, 2019)

2.11.2 Double Diamond

The Design Council was founded in 1944 by Winston Churchill to take part in Britain's "… post-war economic recovery" (Design Council, n.d, para. 2). The Double Diamond framework, introduced in 2003 by the Design Council, was developed to clarify and standardize the design process within innovation practices (Design Council, 2024). It consists of four phases: Discover, Define, Develop, and Deliver.

✦ **Discover:** This phase involves questioning the initial brief and conducting research to understand user needs and the broader context, building an informed foundation for the project.

✦ **Define:** Insights from research are synthesized to identify key issues and establish a clear, focused design brief.

✦ **Develop:** Designers generate, prototype, and test multiple ideas, refining solutions through iteration and exploration.

✦ **Deliver:** The final phase focuses on selecting, refining, and implementing the most effective solution for launch

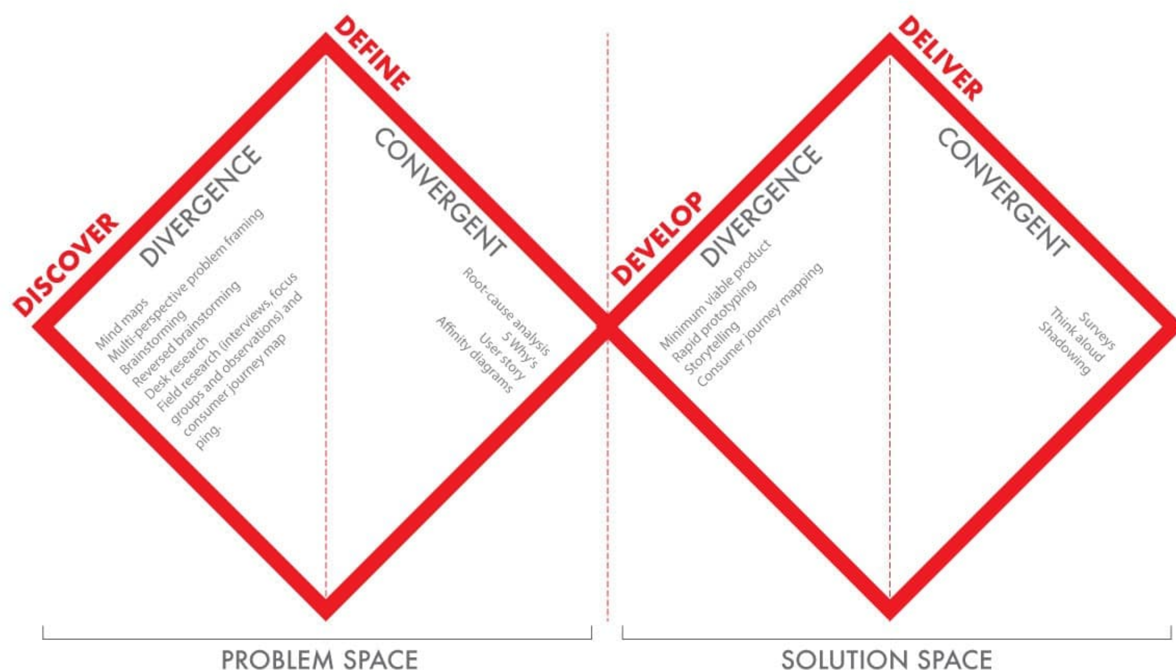


Figure 16: Design Council Double Diamond (Elmansy, 2021)

2.12 Outside > In

‘Outside > In’, also known as The Clock Project, is an assignment given to the 2nd-year Industrial Design Students at Auburn University and was developed by Auburn Professor Shea Tillman.

The goal of The Clock Project is to have students “ learn to draw from, articulate, and expand upon an external inspiration source, distill the values and character from that source, then design a human-interface product using these values and character” (Appendix 1). The students are assigned a word from a bank that changes from year to year and must design a free-standing clock that embodies their assigned word.

The full project brief for ‘Outside > In’ is included in Appendix A of this thesis for further reference.

Chapter 3

New Approach

3.1 Introduction

The following chapter introduces an approach that uses and builds upon IDEO's 3-Stage Design Thinking Process and the Design Council's Double Diamond while introducing charcoal gestures into the ideation phase of the industrial design conceptual ideation process. Photography is added for validation and documentation.

3.1.2 New Approach

Rather than using IDEO's framework for human-centered design, the proposed tool seeks to use it as guide rails to help students generate form-driven, blue-sky ideas while leveraging the divergent and convergent aspects of the double diamond.

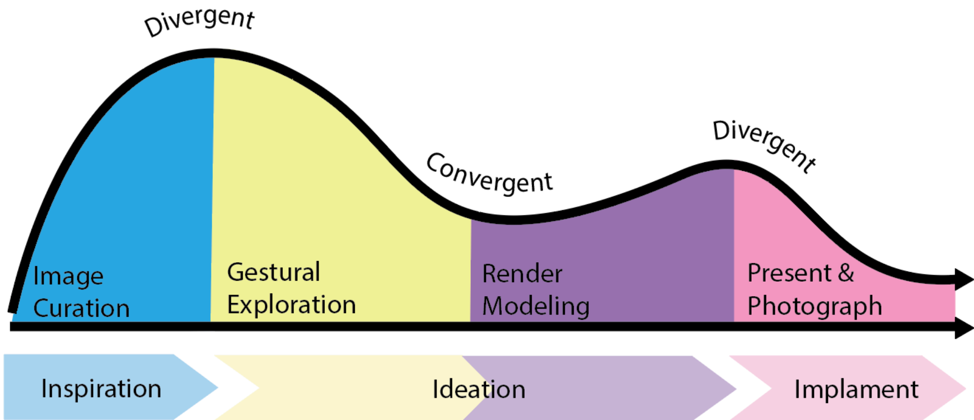


Figure 17: Fine Arts approach Frame Work

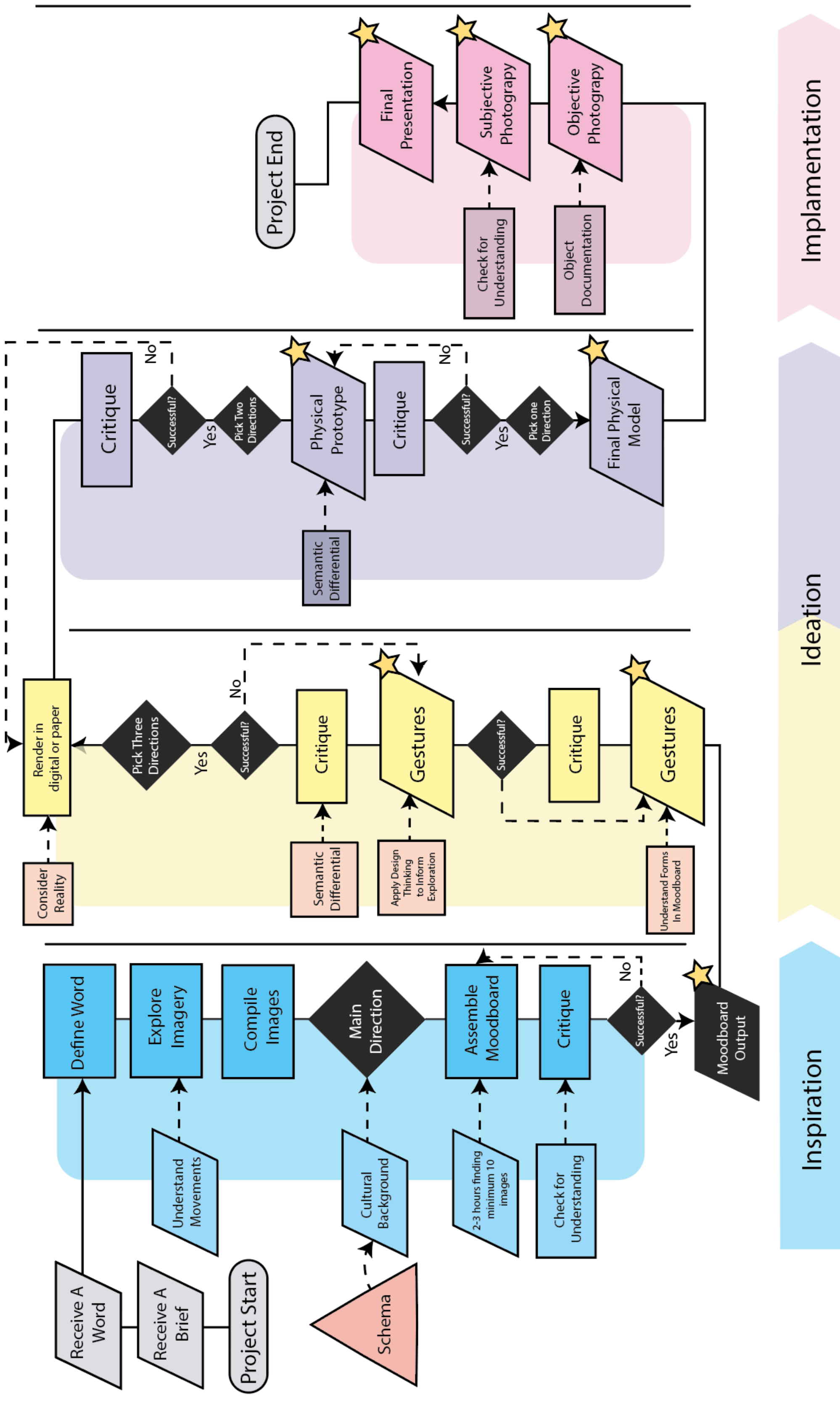


Figure 18a: Fine Arts Approach Flow Chart

★ = deliverable

Symbol	Name	Function
	Start/end	An oval represents a start or end point
	Arrows	A line is a connector that shows relationships between the representative shapes
	Input/Output	A parallelogram represents input or output
	Process	A rectangle represents a process
	Decision	A diamond indicates a decision

Figure 18b: Fine Arts Approach Flow Chart key

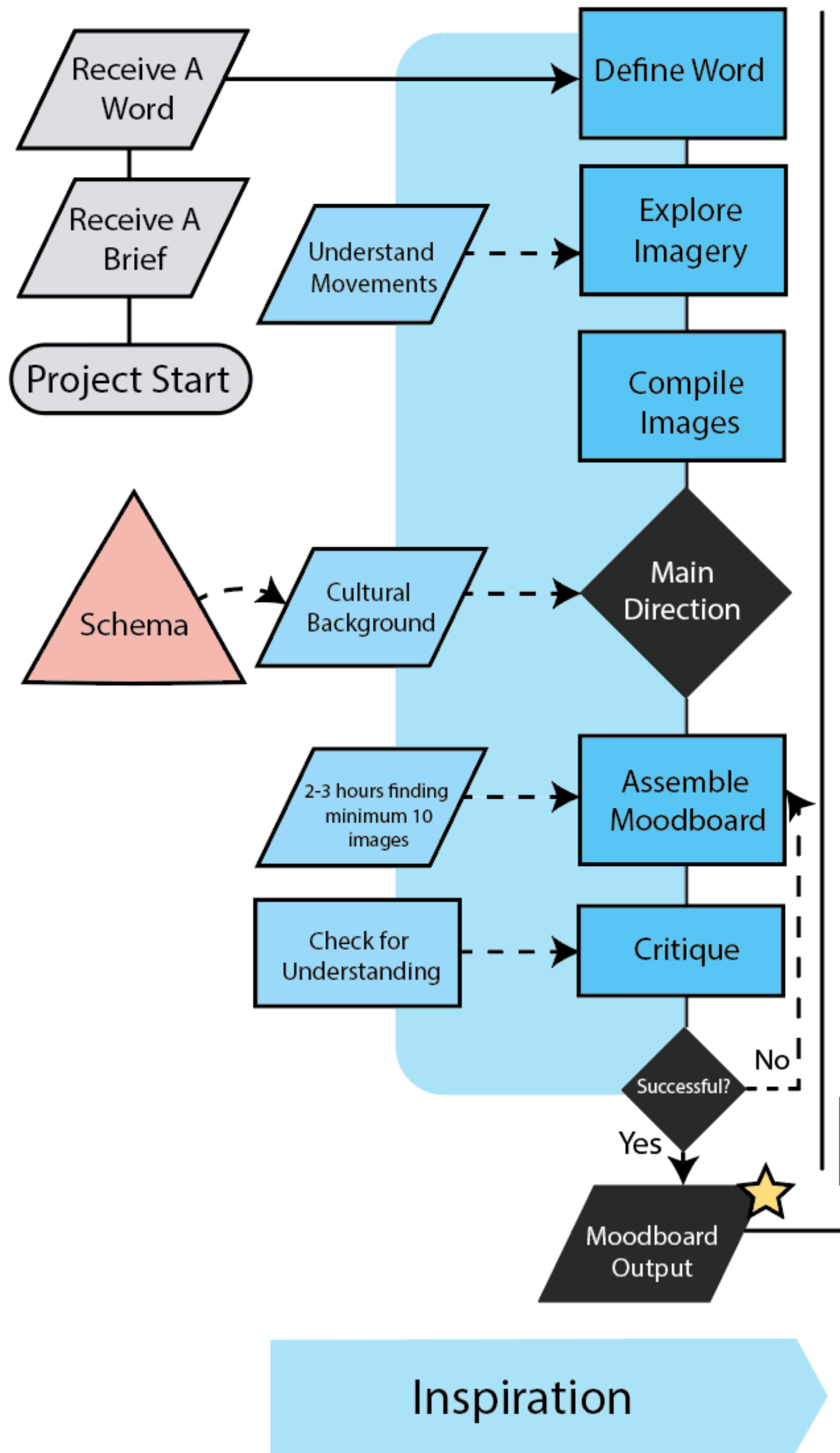


Figure 19: Fine Arts Approach flow chart, Inspiration

3.2 Project Start

The students receive their project brief. The example given in Chapter 4 follows the flowchart through 'Outside > In', also known as 'The Clock Project' (Appendix 1), in which students are assigned a word from a bank and are tasked with designing a clock that embodies that word. The words change from year to year, but examples from past years include Energetic, Quiet, Athletic, and Playful.

3.2.1 Inspiration

Students begin by defining their word in their own vocabulary, then move into image curation and are charged with composing a moodboard that supports their definition. A student who has a stronger background, or 'schema' as mentioned in Chapter 2, often has a stronger frame of reference in this section. Perception is not a passive recording of visual information but an active, interpretive process shaped by prior knowledge, cultural context, and cognitive structure (Shahghasemi, 2017).

3.3 The Moodboard

Once the students' main direction is chosen, a moodboard is composed. The students are instructed to find images that have strong examples of form, and are photographed in black and white to further deemphasize bias based on color. It is recommended that the students look to art, graphic design, architecture, and sculpture for inspiration rather than objects that have already been produced with human interaction in mind. So, they are less likely to focus on reproduction and more on exploring how these forms are applicable to their design.

Pinterest is recommended for image curation because it allows students to compile these photos in one place, as well as considering the recommendations section at the bottom of the Pinterest Board, which curates inspiration based on the images in that specific board. It should be noted that the moodboard should include only images that support the project's word definition. If, for example, the student's word is sharp, all of the imagery should speak to this vocabulary; examples that act to show the antithesis as present in Figure 20 should be omitted in favor of an image that supports the assigned vocabulary.

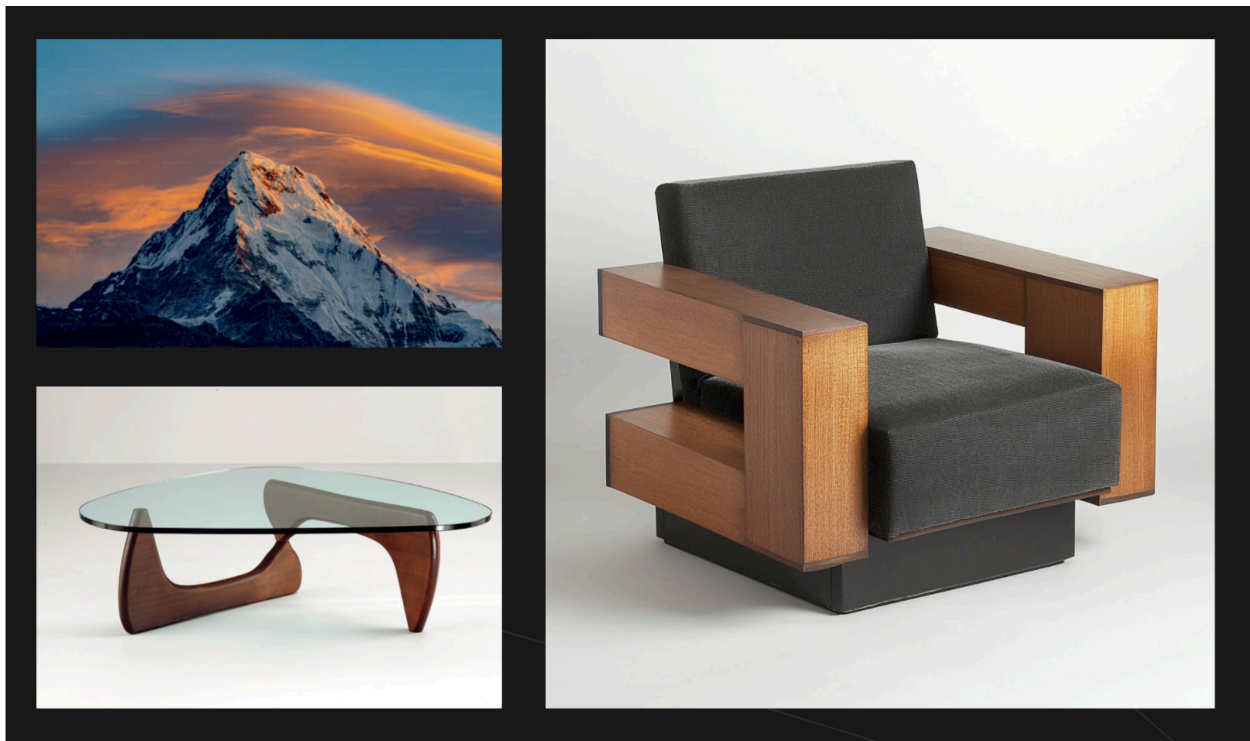


Figure 20: Moodboard Better If

Once ten final images are selected, the students are instructed to arrange them within a grid. This recommendation is made to keep the moodboard's focus on the images rather than on their arrangement. Ten images are chosen as a minimum; if a student wishes to find more, they may, but ten was chosen as a recommended minimum for the assignment.

Figure 21: Proposed Moodboard Style

The faculty engage the students design process through a critique to evaluate the effectiveness of the students' visual communication of their assigned word. If the student is not able to effectively convey their word through their selected imagery, assigned word, and definition; problematic images can be swapped out, or the students may be instructed to repeat the image curation again after the critique.

The final output of the inspiration section is the referential moodboard. While the ideation section produces a final conceptual design direction, the student may continue to find and add supporting images if they wish.

3.4 Ideation

The ideation phase is split into two portions: Gestural ideation and physical modeling, shown below in yellow (Gestures) and purple (Modeling).

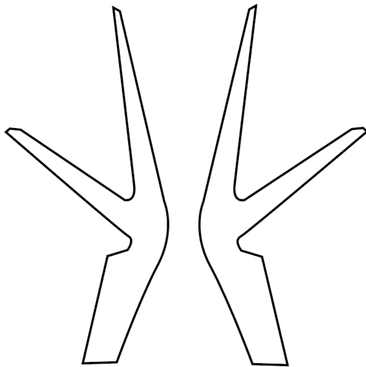
Figure 22: Fine Arts Approach flow chart, Ideation

The ideation portion begins with charcoal gestures, completed on newsprint to allow for full-body movement. The ideation portion is engaged with the intent to visually dissect the chosen moodboard imagery. At this point, students are drawing or sketching what they see to better understand the structural relationships that convey certain 'feelings' or visual weights. Students deconstruct their images into primary, secondary, and tertiary elements to begin understanding and evaluating the correlations among these factors in their chosen imagery.

Willow charcoal is recommended because of its delicate nature. Other forms of charcoal can be used if students want to avoid transferring charcoal dust to their hands. Pressed or charcoal pencils are also a good option, but pressed charcoal tends to require more force to make useful marks.

The recommended sketch pad is newsprint. The Strathmore 300 Series Rough Newsprint Pad, 18in x 24in, was used for the examples provided in Chapter 4 of this thesis.

Students are instructed to begin by exploring the relationships among the forms in their chosen imagery, breaking down their images into light and shadow, or into primary, secondary, and tertiary forms.



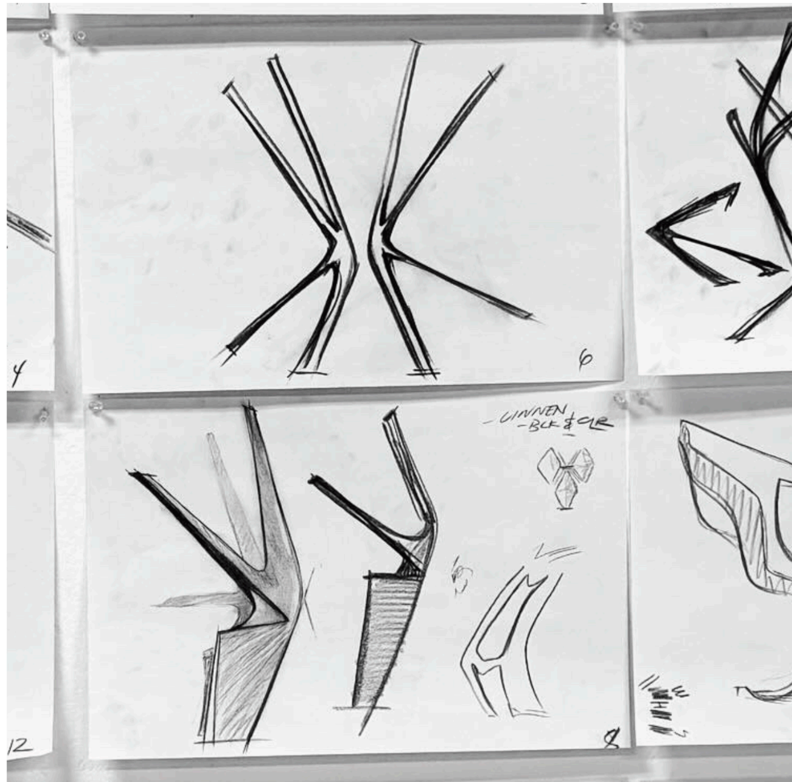


Figure 23: Relationship extrapolation and initial gestures

These initial gestures serve as a first step toward understanding why those particular images were interesting to them and which elements stood out. Moodboards often feature strong images, but without striving to understand them, the key reasons they were interesting to begin with may not carry over to the product. The initial gestures serve as quick conduits for understanding, so instead of having to render an object in full, they still interact with the forms present in the photograph. These should not take longer than two minutes per page or single exploration.

A critique is conducted with faculty after the first round of ideation gestures to assess and discuss students' progress and evaluate whether they effectively understand the forms in their moodboards. The student can return to the start of the initial gesture portion if they were not effective at distilling the visual information

presented in their chosen imagery. These gestures may be reassessed after further exploration.

Another round of sketching follows this critique, again with the charcoal, while continuing to reference the moodboard. During this round, students use their gestures to ideate form in tandem with any factor that may realistically begin to impact the final design (Material choice, part lines, necessary internals, etc.)

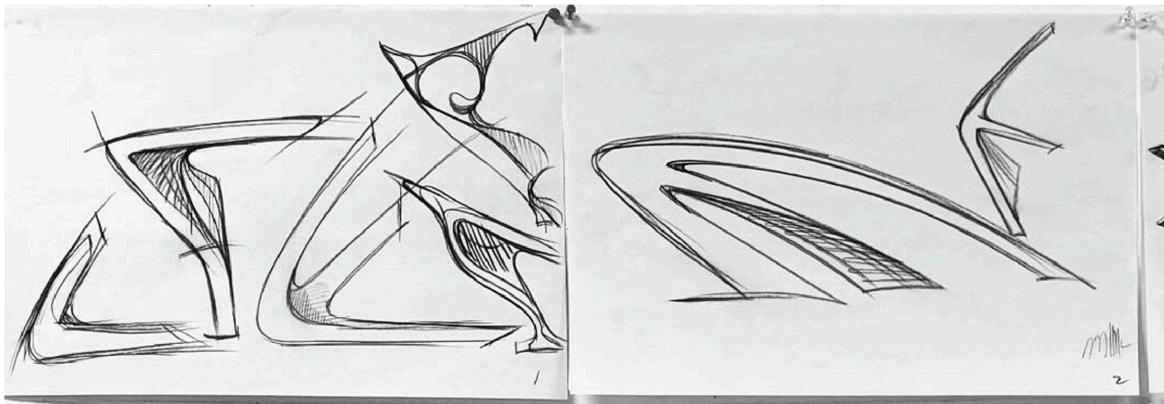


Figure 24: Form abstraction and experimentation

The critique that follows is ideally conducted with whole-class participation, and the semantic differential (on a scale of -3, -2, -1, 0, +1, +2, +3) is used to quantify the extent to which the students' gestures align with their chosen visuals. The semantic differential includes a line of two opposing terms (Soft - Hard) or (Rough - Smooth). In practice, this would be the student's assigned word and an opposing adjective to

evaluate its effectiveness. The students put tick marks along the numbered line to show where they feel the design lands between the two words.

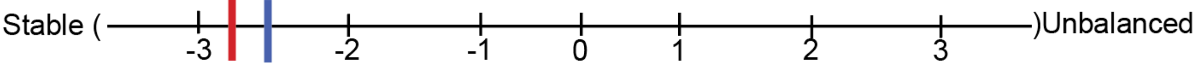


Figure 25: Semantic Differential Scale Example

This scale also serves as a potential confirmation of visual literacy among the students present in the critique. As the effectiveness of the sketch's communication is evaluated by the students in the cohort, the students' ability to interpret the visuals is also being evaluated. The student may return to the start of this round if it is determined that the gestures do not align with their visual vocabulary.

The students are required to produce three distinct conceptual areas to explore in the next round. At the start of the second phase of ideation, students may choose to explore their concepts with renders, either traditionally on paper or, if they have enough experience, digitally on a tablet.

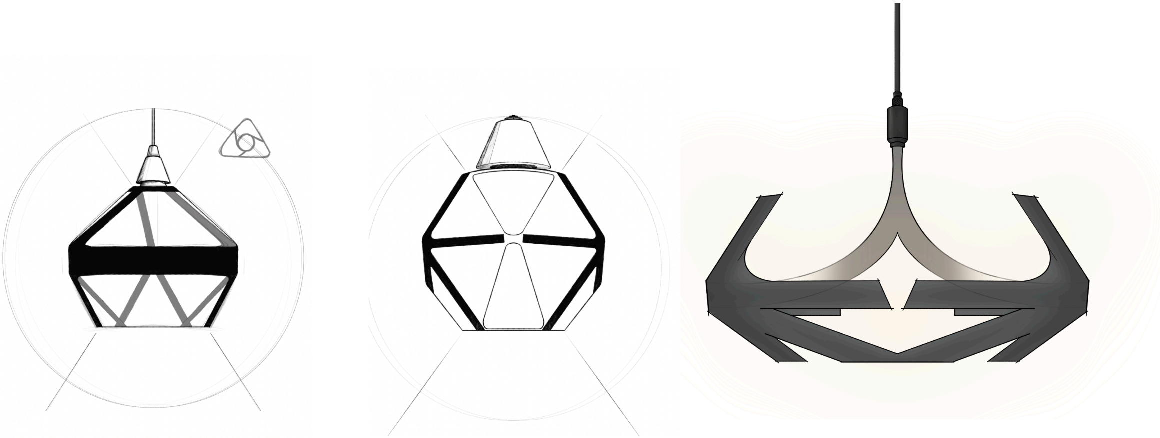


Figure 26: Example Renders, Digital

A critique is conducted by compiling the final renders, once again using the semantic differential to quantify their effectiveness in communicating the word. After a critique with faculty, the student may proceed forward and begin 3d ideation, or the student may return to the start of the rendering portion if they feel they were not effective at distilling the visual information presented in their chosen imagery.

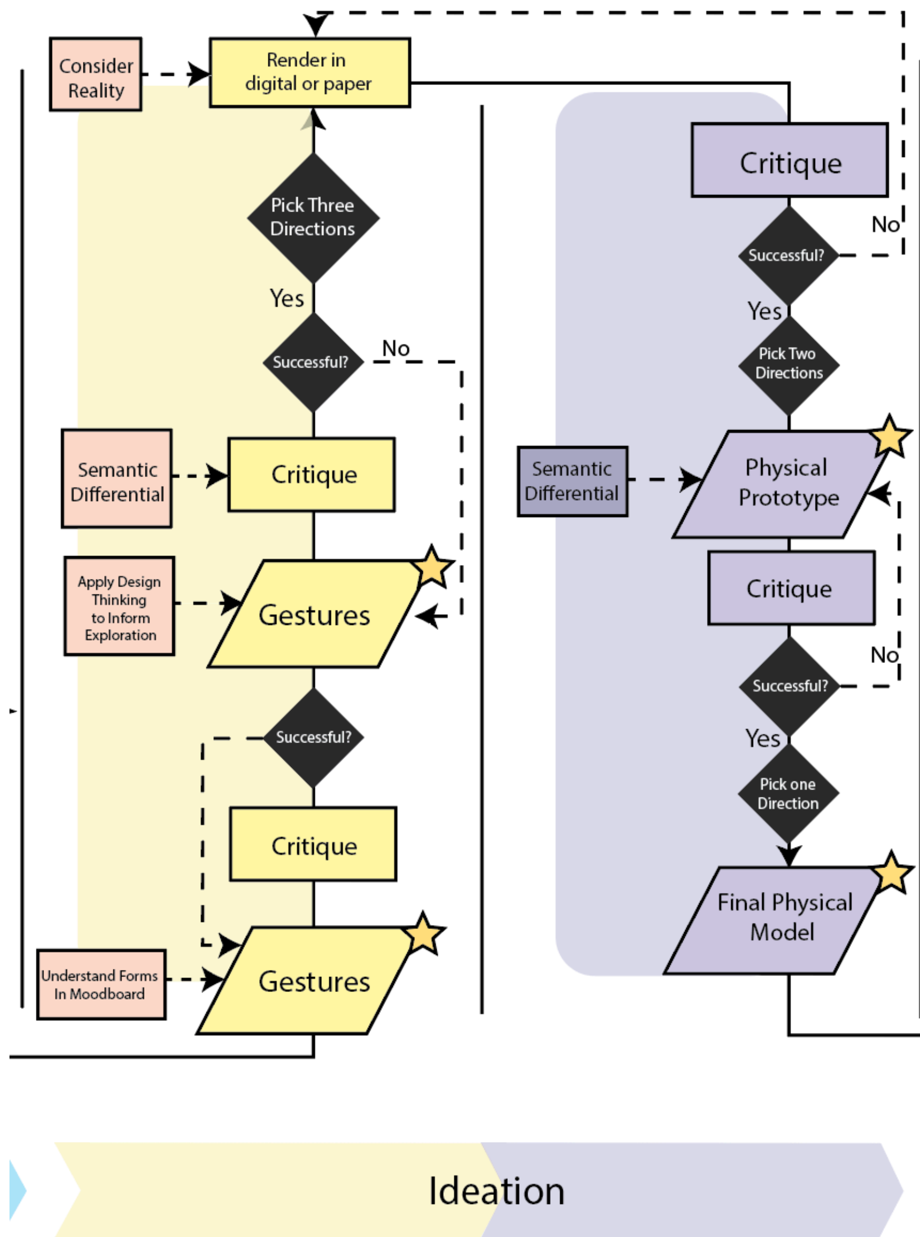


Figure 27: Fine Arts Approach flow chart, Ideation

3.5 Model Making

Once the student is ready to move into 3D, they can do so in proto foam (or any carvable, safe foam variant), C.A.D, or automotive clay, or whichever material they are most comfortable with. The students should further explore and solidify the forms by 3D-prototyping two of the three previously discussed rendered directions. The mockups are evaluated with critique and semantic differential before students move into the final production.

3.6 Implementation

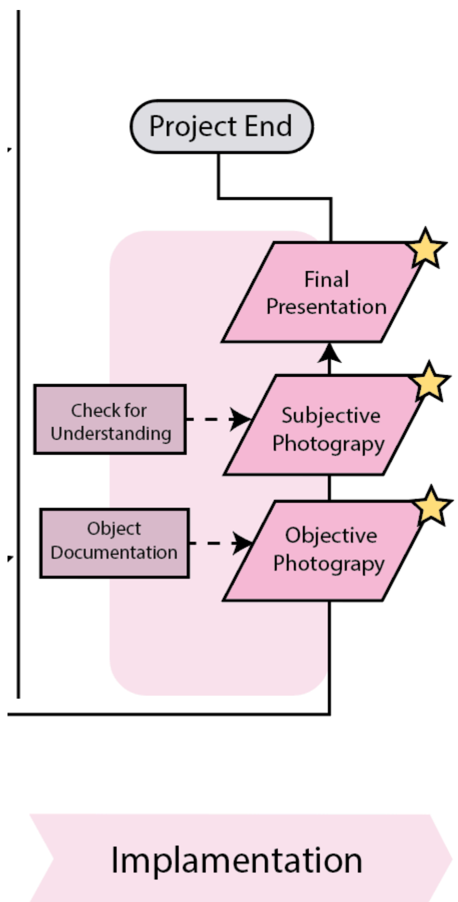


Figure 28: Fine Arts Approach flow chart, Implementation

Upon completion of their final object, students are instructed to capture both objective and subjective images that will be included in their final presentation for that portion of the studio.

Objective photography, which simply captures different angles of the final object, should be evaluated based on image quality, exposure, and composition (Is the object in the frame? Are all angles adequately shown?). Objective photography is used to

document and evaluate the object without the added information that an environment provides. It’s best that the students photograph these in a photoroom with a plain background.

Figure 29: Objective Photo Example, MAC Lipstick

Subjective photography aims to convey the assigned vocabulary without the student being present to defend or explain the image to observers, and serves as the final text of the student’s visual literacy. Subjective photography strives to convey a message as its purpose, and the students are instructed to photograph their object in an environment that best supports their design intent to the best of their ability. The effectiveness should be evaluated based on the overall conveyance of the verbiage, and it may be best to present these images to a group of individuals who know nothing about the student's work to truly see whether their final communication is effective.

Figure 30: Subjective Photography, MAC Lipstick, with consent from Emma Guthrie

Chapter 4

Demonstration

4.1 Introduction

The following chapter demonstrates the approach discussed in Chapter 3.

4.1.2 Project Start

The ‘Outside > In’ assignment begins as the students are given the design brief. They are to develop a clock, and the targeted student learning outcome from this portion of the semester is to ‘learn to draw from, articulate, and expand upon an external inspiration source’ (Appendix 1). The student in this demonstration has been randomly assigned the word "**Stable”**. The student is tasked with developing their own definition for Stable:

“Stable (Adj): Not easily moved. Long-lasting. Rigid.”

4.2 Inspiration

The student has the benefit of exploring existing art movements that they feel exemplify those same qualities. They feel that Art Deco aligns most closely, so their initial explorations explore Art Deco and the Bauhaus movements, primarily in graphics and architecture.

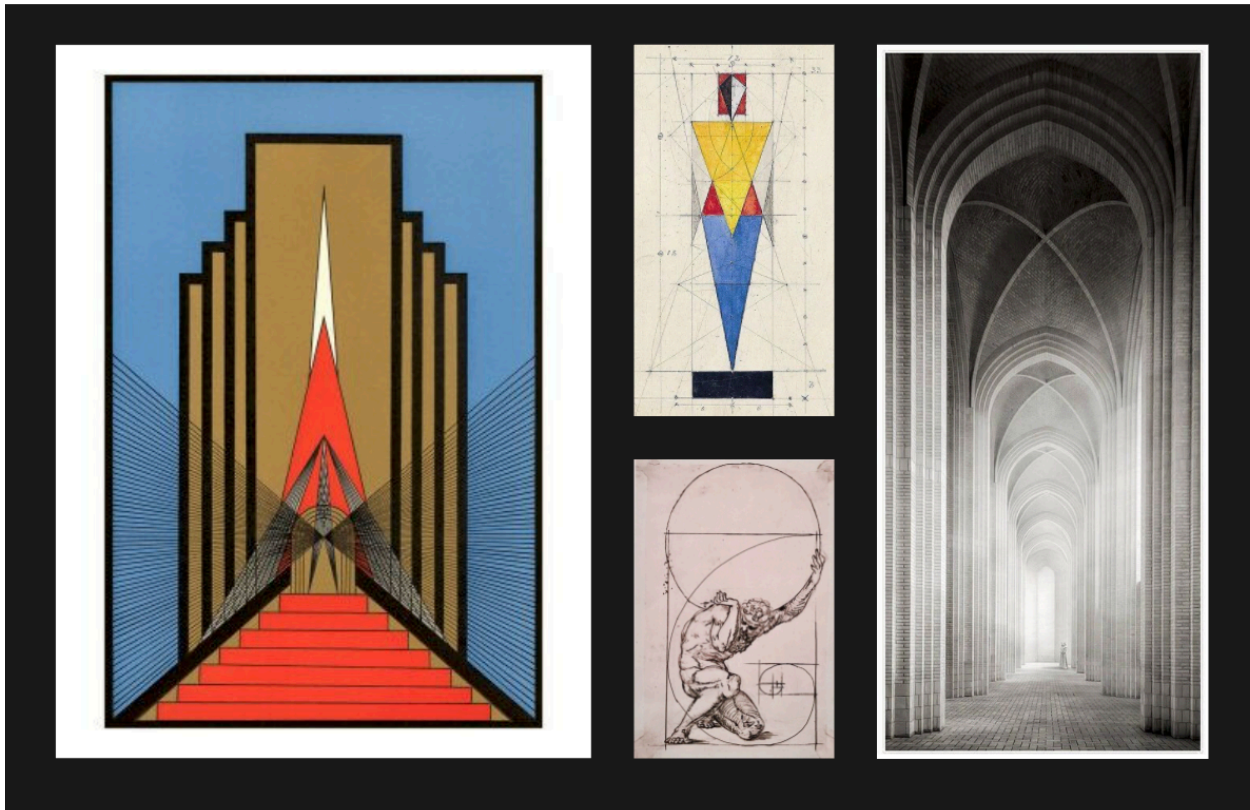


Figure 31: Initial inspiration

4.3 The Moodboard

After further exploration, the student became increasingly interested in architecture, focusing on structures that had otherwise crumbled. This proved to the student that the arches were 'stable' and capable of withstanding the effects of time, while other portions of the building had failed or were otherwise reduced to rubble. The student began exploring the forms and understanding the structural proportions behind arched entries and columns.

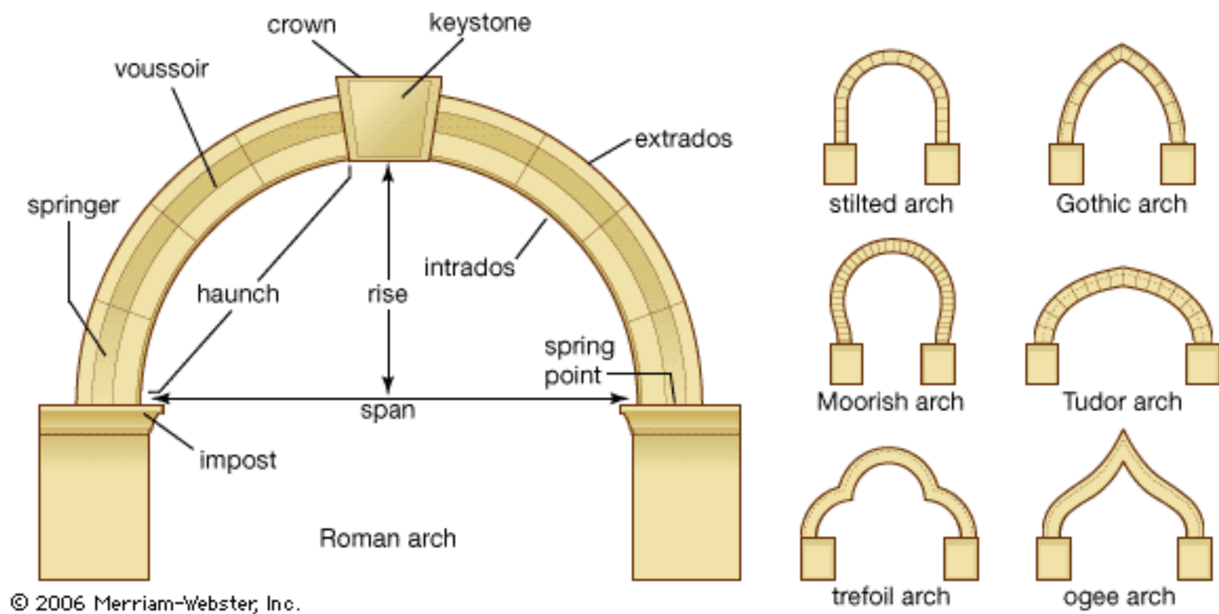


Figure 32: Archway types (Encyclopedia Britannica, 2006)

Figure 33: Final Moodboard

The final moodboard is a culmination of the final ten images that they feel most strongly support their direction. Following a critique between the student and the faculty, the direction was approved, and the student proceeds to the gesture phase of the project.

4.4 Ideation

In the first round of gestures, the students are tasked with breaking down the forms in their chosen imagery. The gestures are completed on newsprint with charcoal.

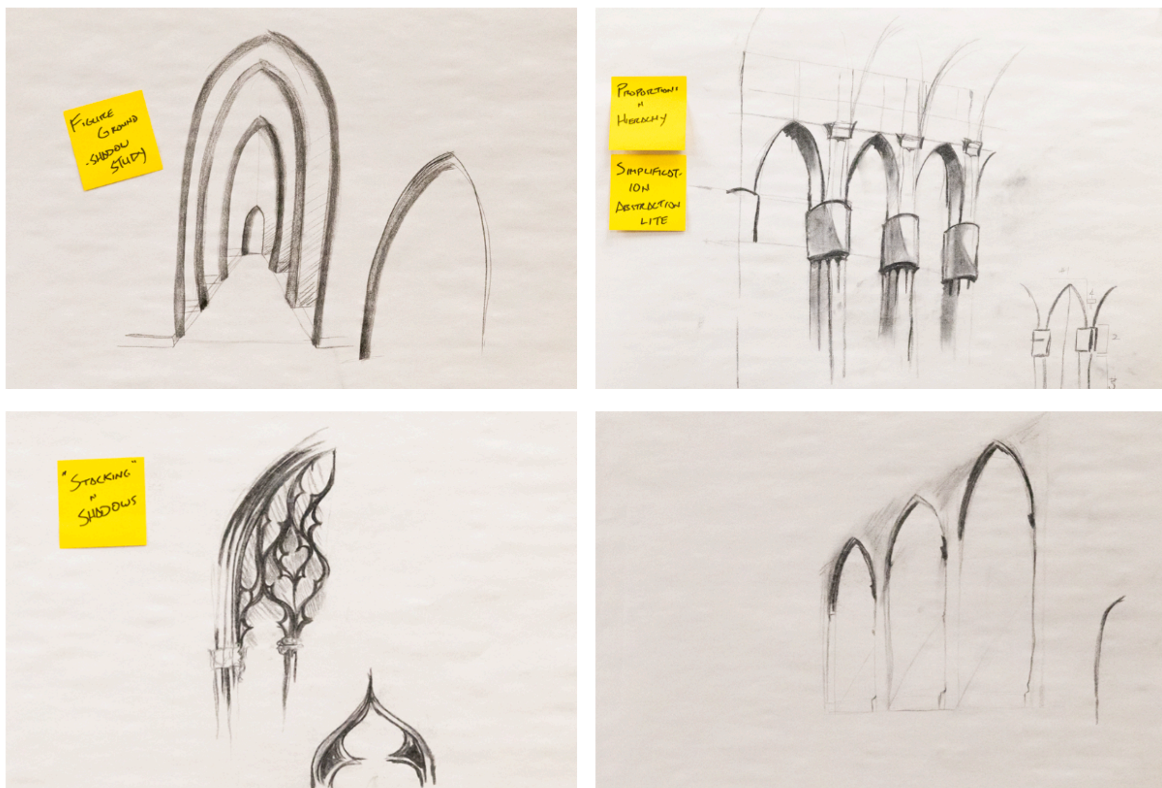


Figure 34: Stable, Initial Gestures

It is decided that the student effectively translated the imagery in their moodboard, and they move forward to the next round of ideation.

The 2nd round of gestures begins to consider what the clock would look like with the aspects of the moodboard that were pulled out and experimented with. Where would the face go? Are there multiple faces? How would the criteria present that make this object a clock interact with what was pulled out of the photographs as inspiration?

Figure 35: Second Round of Iterations

The 2nd round of gestures is evaluated by the faculty and the other students in the studio. The gestures were evaluated using a semantic differential; the student chose opposing words to those they were trying to visually communicate.

In this case, the student's word is 'Stable', so the opposing word was chosen as 'Unbalanced'.

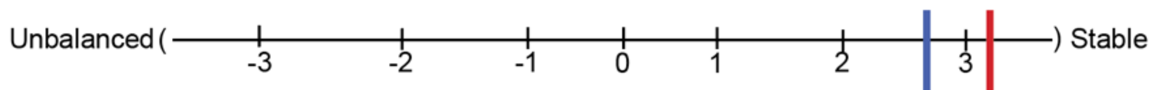


Figure 36: Semantic Differential with Approximated Marks

The blue and Red marks on the line represent those on a printed sheet of paper. For these examples, the blue mark is the faculty, and the red marks are the median of student inputs.

The student is successful in communicating the desired effect and moves towards rendering three distinct directions for their product.

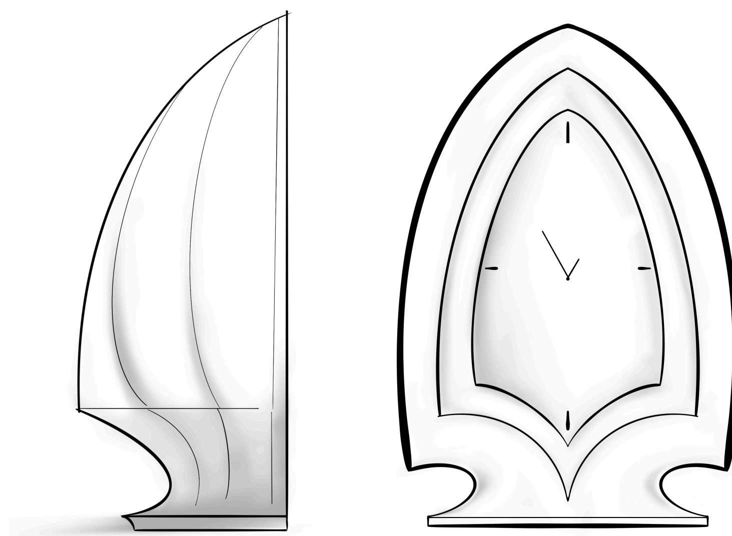


Figure 37: Render One, Digital

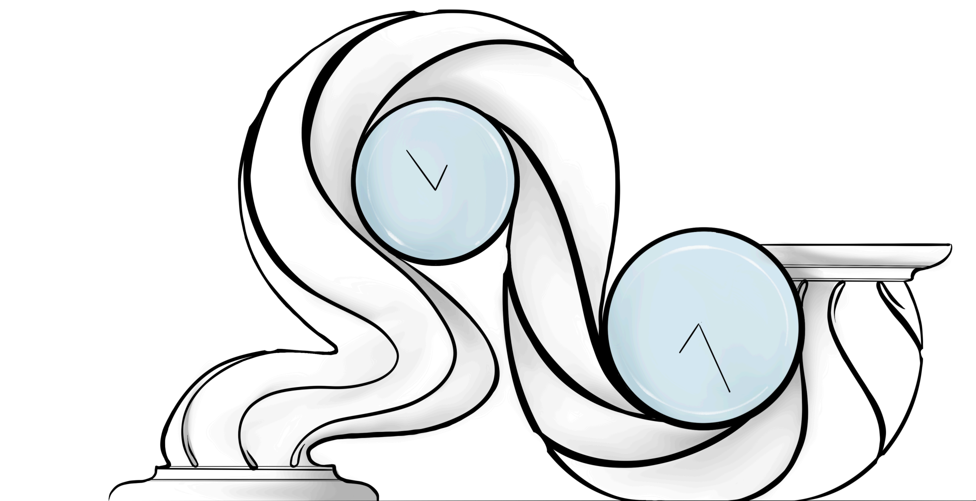


Figure 38: Render Two, Digital

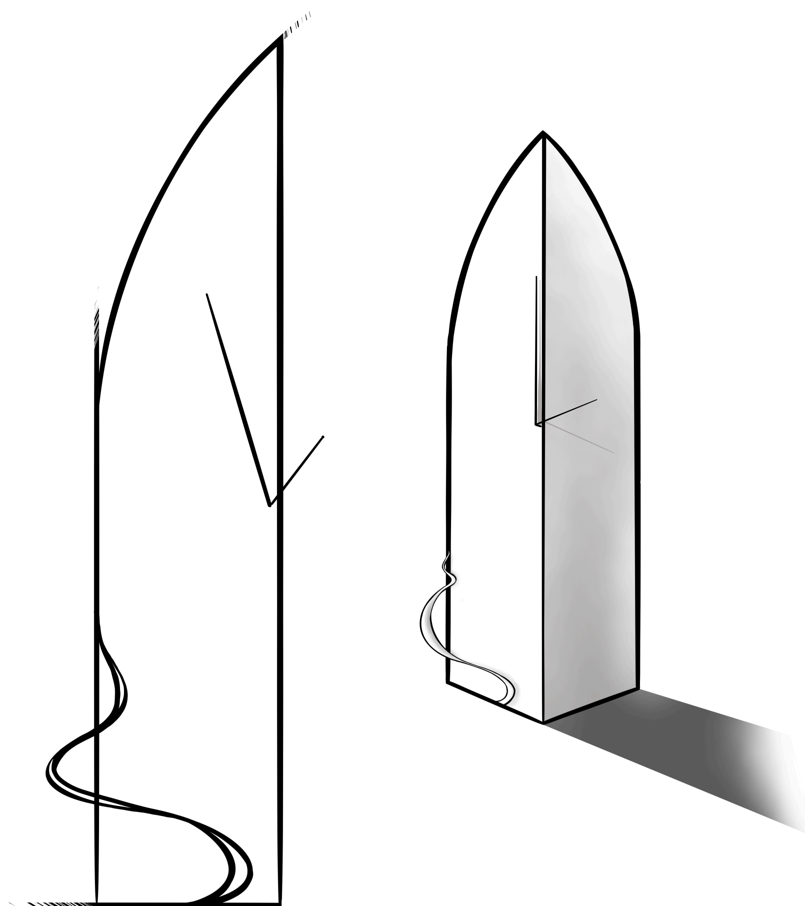


Figure 39: Render Three, Digital

4.5 Model Making

Following the rendering portion, the students move into physical prototyping. They are given the option to explore two directions in proto foam or in CAD. This student choses to explore their renders in CAD (Renders Three and One).

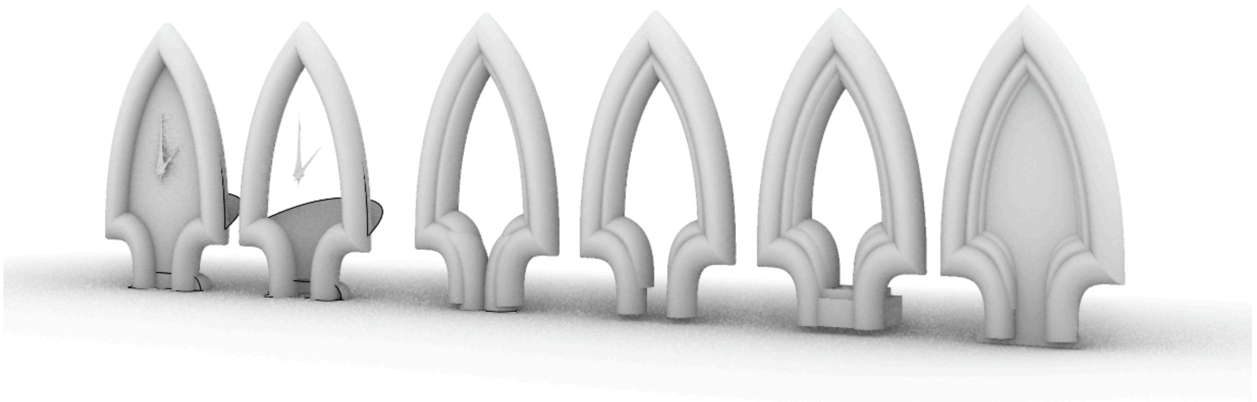


Figure 40: Rhino Modeling, Render One

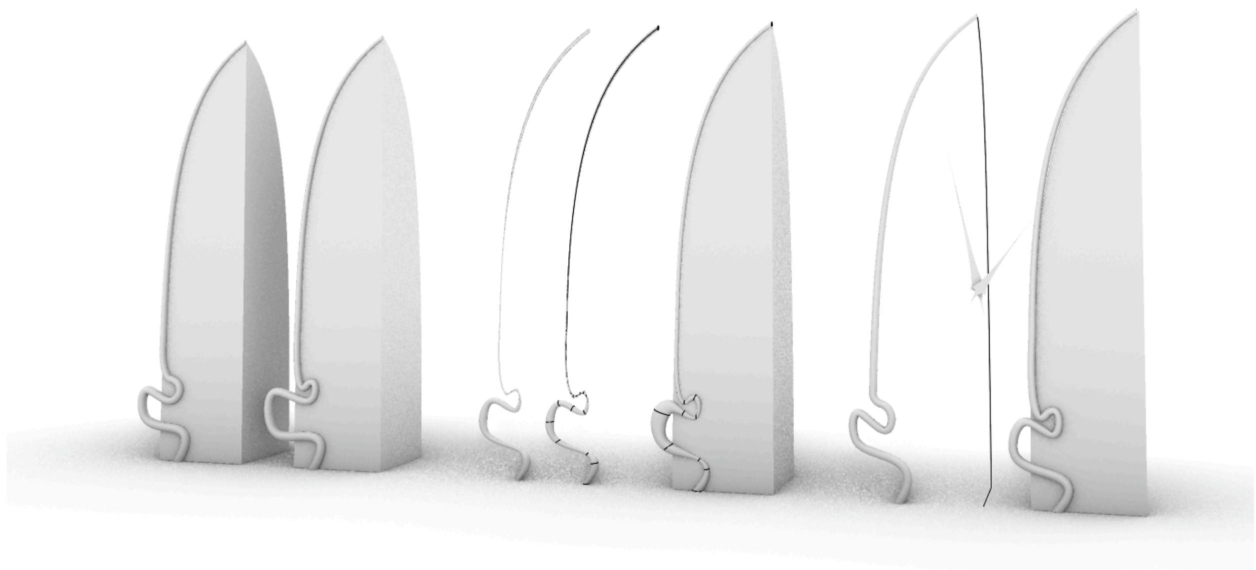


Figure 41: Rhino Modeling, Render Three

The student 3D printed these models for another round of semantic differentials. Both models were evaluated using the same words as before. The student chooses a final direction following the critique. It is recommended that they continue pursuing the design that most closely aligns with the assigned word.

With the help of faculty and student critique as well as a semantic differential, it was decided that the forms didn't actually express 'Stable', and the student did another round of ideation in CAD on one final idea of the two.

Render One was chosen for further ideation, because although the overall presence didn't quite read as stable, the visual cues were more strongly aligned with the moodboard.

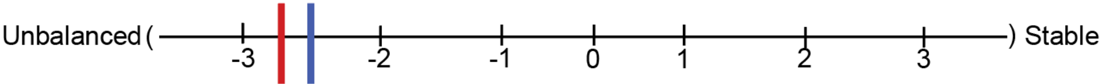


Figure 42: 3D Print Differential Evaluation

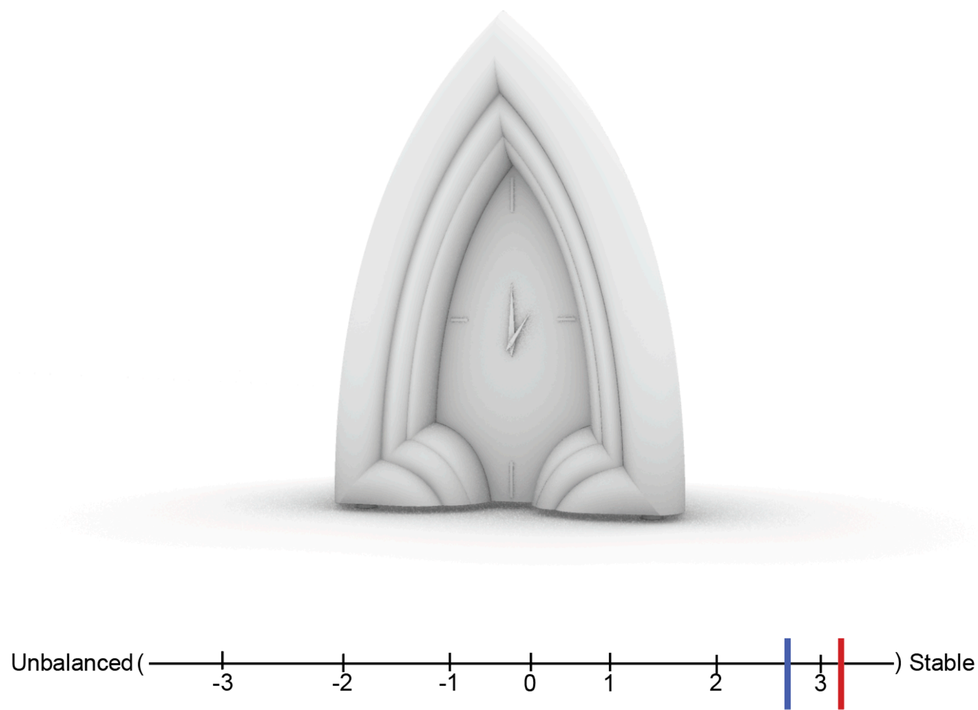


Figure 43: Final Model Semantic Differential Evaluation

4.6 Implementation

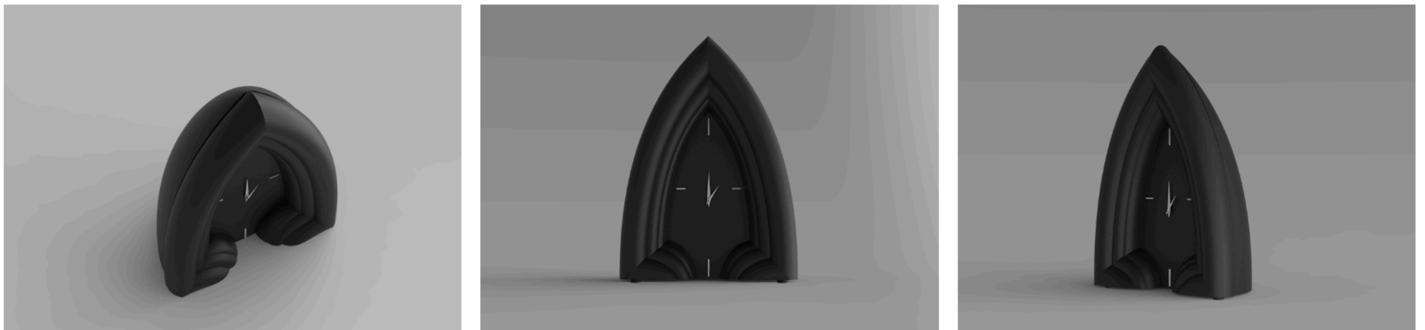


Figure 44: 'Stable' Final Photographs, Keyshot

Once the final model is completed, the students complete documentation of their final model. Their objective photography is evaluated based on lighting and exposure, and whether all angles have been documented and submitted.

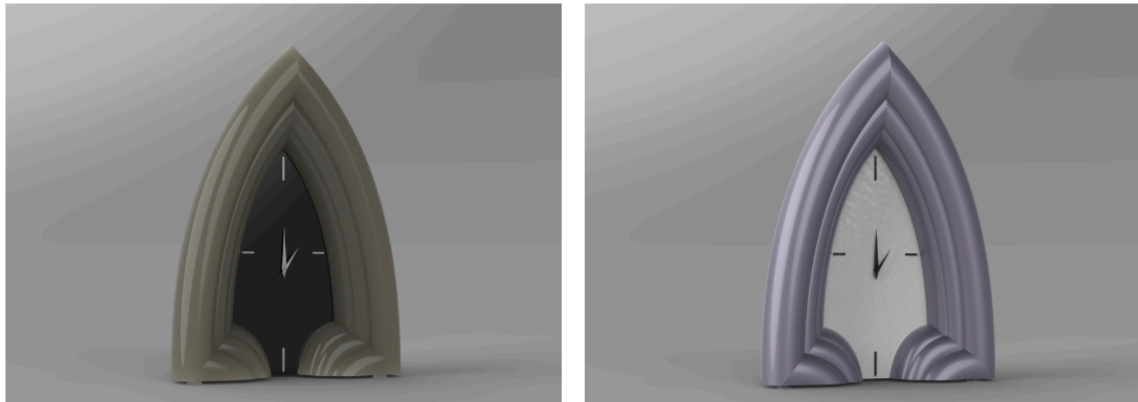


Figure 45: Color Experimentation

The subjective photography is done in a space that the students see as the ideal environment for this clock. The photographs in this case serve as the final communication between designer and observer and are evaluated by how strongly the message is conveyed.

Figure 46: ‘Stable’ clock, Subjective photo, keyshot

Chapter 5

Conclusion

5.1 Course Structure

Students at Auburn can experience photography through their INDD 3130 class. The course has gradually changed over time, and has seen the incorporation of digital photography as well as the reintegration of analog and darkroom photography. It could be beneficial to include photography earlier in their curriculum to assess whether an early foundation in photography would affect their ability to communicate throughout the remaining years at Auburn and beyond.

Assuming that students' skills do indeed build upon one another, there may be a strong argument for earlier introduction to students.

5.2 Room for Exploration

The effects of this process have not been evaluated outside the hypothetical context, but with further investigation, it would be interesting to see how approaching ideation this way would affect individuals who don't necessarily have arts-based approaches to design. Or evaluating how people outside the design field might approach going through this process.

5.3 Appendix 3 Content

Appendix 3 is a handout developed to guide faculty through the process, with more in-depth visual examples, intended as an easily digestible version of the content in this thesis.

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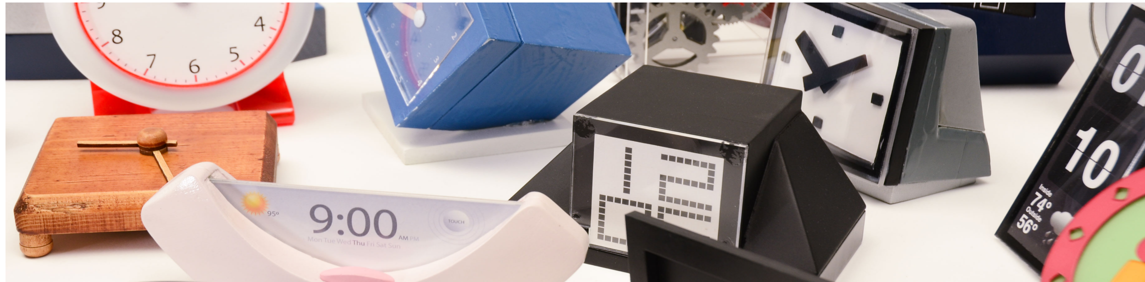
Appendix 1:

Project 1: Outside > In – *Balancing externally-inspired form with functionality*

INDD-2210 3D Principles of Industrial Design Spring 2025



There are endless sources of inspiration for design. Each designer draws from an inspiration source to "fuel" their design ideas. Sometimes these sources are an internal function of the artifact, at other times they are external factors with which the product must align itself. The goal of this project is to learn to draw from, articulate, and expand upon an external inspiration source, distill the values and character from that source, then design a human-interface product using these values and character.

Assignment

Students will design a freestanding clock that can be displayed on a 6"x 8" surface. Based on a descriptive adjective assigned in class, students will develop forms through sketches and physical models in order to explore descriptive volumes and surfaces. After a single concept is selected, it will then be further refined towards the final design through iterative models. The final deliverable of this project will be a full-scale appearance model, fabricated to be "photo-ready", accompanied by a 150-word thesis statement. This statement should explain, reflect upon, and defend the rationale of design decisions.

Teaching Points

Distilling abstract themes and attributes into form and aesthetic character.
Balancing character of form with human-factors considerations.
Refinement through iteration, leading to systematic concept evolution.
Developing a realistic, detail rich, physical appearance model.
Improving verbal presentation skills.

Schedule and Deliverables

01.15 (Wed) –
'Moodscapes' posted that capture the visual essence (character) of the expanded attribute.
Three potential design themes that solve as a visual launch-pad for your given adjective.

01.17 (Fri)
– *10 (minimum) concepts posted, sketched* (8.5x14 format), embodying visual themes.
01.20 (Mon)
– MLK Holiday (no class).
01.22 (Wed)
– 2 additional sketched directions and three-dimensional sketch models (*3 minimum*).
01.24 (Fri)
– Three refined form concepts illustrating themes for review *(sketch model development.)*
01.27 (Mon)
– Three new sketch model variants for that show concept development from Friday.
01.29 (Wed)
– Illustrator drawings of face/color/finish/part detail concepts *(20 minimum printed).*
02.03 (Mon)
– Completed form development. Final finish work on appearance model.
Apply finish details & draft thesis statement (what and why).
02.07 (Fri)
– Final appearance model and thesis statement due for presentation.
02.10 (Mon)
– Project reflection document due.

Evaluation

20% Background and Understanding
Research, theme development, and ideation.

40% Design Development
Strength of concept and development, and study model quality.

40% Design Implementation
Quality of form and refinement, appearance model quality and craft, and thoughtfulness of thesis statement.

Shea Tillman

Appendix 2:

Project 1: Outside > In – *Balancing externally-inspired form with functionality*

INDD-2210 3D Principles of Industrial Design Proposal

There are endless sources of inspiration for design. Each designer draws from an inspiration source to "fuel" their design ideas. Sometimes these sources are an internal function of the artifact, at other times they are external factors with which the product must align itself. The goal of this project is to learn to draw from, articulate, and expand upon an external inspiration source, distill the values and character from that source, then design a human-interface product using these values and character.

Assignment

Students will design a freestanding clock that can be displayed on a 6"x 8" surface. Based on a descriptive adjective assigned in class, students will develop forms through sketches and physical models in order to explore descriptive volumes and surfaces. After a single concept is selected, it will then be further refined towards the final design through iterative models. The final deliverable of this project will be a full-scale appearance model, fabricated to be "photo-ready", accompanied by a 150-word thesis statement. This statement should explain, reflect upon, and defend the rationale of design decisions.

Teaching Points

Distilling abstract themes and attributes into form and aesthetic character.
Balancing character of form with human-factors considerations.
Refinement through iteration, leading to systematic concept evolution.
Developing a realistic, detail rich, physical appearance model.
Improving verbal presentation skills.

Evaluation

Background and Understanding
Research, theme development, and ideation.

Design Development
Strength of concept and development, and study model quality.

Design Implementation
Quality of form and refinement, appearance model quality and craft

Background and Understanding (12 pts. total)
Research, theme development, and ideation.

Definition Generation (1 pt.)

Student turned in their own definition, typed (1 pt.)
Not On-Time or nothing submitted - 0 points
Yes - 1points

Moodboard (11 pts.)

The student has the required number of images (10) (1 pt.)
Not On-Time or nothing submitted - 0 points
Yes - 1points

Image Grid Quality (5 pts.)
No 0 points
Poor 1 points
OK 2 points
Good 3 points
Great 4 points
Excellent 5 points

The images support established mood (5 pts.)
No 0 points
Poor 1 points
OK 2 points
Good 3 points
Great 4 points
Excellent 5 points

Design Development (72 pts. Total)
Strength of concept and development, and study model quality.

Initial Gestures (15pts.)
Minimum of 8 pages of explorations due pinned up at the beginning of class

Gestures are pinned up by the start of class (1 pt.)
Not On-Time or nothing submitted - 0 points
Yes - 1points

Gestures explore forms present in the moodboard (5 pts.)
No 0 points

Poor 1 points
OK 2 points
Good 3 points
Great 4 points
Excellent 5 points

Word is conveyed through gestures (5 pts.)
No 0 points
Poor 1 points
OK 2 points
Good 3 points
Great 4 points
Excellent 5 points

Critique Participation (3 pt.)
No Participation - 0 points
Yes - 3 points

Gestures photographed and submitted online (1 pt.)
Not On-Time or nothing submitted - 0 points
Yes - 1points

Secondary Gestures (21 pts.)
Minimum of 8 pages of explorations due pinned up at the beginning of class

Gestures are pinned up by the start of class (1 pt.)
Not On-Time or nothing submitted - 0 points
Yes - 1points

Design thinking is applied to initial exploration gestures (5 pts.)
No 0 points
Poor 1 points
OK 2 points
Good 3 points
Great 4 points
Excellent 5 points

Word is conveyed through gestures (5 pts.)
No 0 points
Poor 1 points
OK 2 points
Good 3 points
Great 4 points
Excellent 5 points

Initial ideation for primary, secondary, and tertiary features to be present on the object (5 pts.)
No 0 points
Poor 1 points
OK 2 points
Good 3 points
Great 4 points
Excellent 5 points

Semantic Differential Critique Participation (4 pt.)
No Participation - 0 points
Yes - 4 points

Gestures photographed and submitted online (1 pt.)
Not On-Time or nothing submitted - 0 points
Yes - 1points

Rendering (26 pts)
3 renders, digital or hand renderings, due to be pinned up at the beginning of class

3 renders are pinned up by the start of class (1 pt.)
Not On-Time or nothing submitted - 0 points
Yes - 1points

Word is conveyed through renders (5 pts.)
No 0 points
Poor 1 points
OK 2 points
Good 3 points
Great 4 points
Excellent 5 points

Student considers manufacturability and material choice (5 pts.).
No 0 points
Poor 1 points
OK 2 points
Good 3 points
Great 4 points
Excellent 5 points

Quality of Render (clean lines, shading, cast shadow) (5 pts.).
No 0 points
Poor 1 points
OK 2 points
Good 3 points

Great 4 points
Excellent 5 points

Considers primary, secondary, and tertiary features to be present on the object (5 pts.).
No 0 points
Poor 1 points
OK 2 points
Good 3 points
Great 4 points
Excellent 5 points

Semantic Differential Critique Participation (4 pt.)
No Participation - 0 points
Yes - 4 points

Renders scanned or digitally submitted online (1 pt.)
Not On-Time or nothing submitted - 0 points
Yes - 1points

Design Implementation (84 pts. Total)

Quality of form and refinement, appearance model quality, and craft

Modelmaking (22 pts.)
Early models are used to further flesh out the ideas explored in gestures and renders. This round is more about 3D understanding, not yet bridging to the final form. Gestures in a paper mockup, CAD model, or foam model are acceptable.

6 3D explorations present for the start of class (1 pt.)
Not On-Time or nothing submitted - 0 points
Yes - 1points

A minimum of 3 models for 2 rendered directions (1 pt.)
Not On-Time or nothing submitted - 0 points
Yes - 1points

Models explore and expand on forms established in previous iterations (Gestures, Renders) (5 pts.)
No 0 points
Poor 1 points
OK 2 points
Good 3 points
Great 4 points
Excellent 5 points

Models experiment with small-scale aspects as well as large-scale proportions of the overall object (5 pts.)
No 0 points
Poor 1 points
OK 2 points
Good 3 points
Great 4 points
Excellent 5 points

Word is conveyed through Models (5 pts.)
No 0 points
Poor 1 points
OK 2 points
Good 3 points
Great 4 points
Excellent 5 points

Semantic Differential Critique Participation (4 pt.)
No Participation - 0 points
Yes - 4 points

Photos of models submitted online (1 pt.)
Not On-Time or nothing submitted - 0 points
Yes - 1points

Final (25 pts.)
Model present at the start of class.

Final Model present for the start of class (10 pt.)
Not On-Time or nothing submitted - 0 points
Yes - 10 points

Word is conveyed through Model (5 pts.)
No 0 points
Poor 1 points
OK 2 points
Good 3 points
Great 4 points
Excellent 5 points

Surface has been prepped, sanded, and adequately prepped on the model (5 pts.)
No 0 points
Poor 1 points
OK 2 points
Good 3 points
Great 4 points

Excellent 5 points

Final Model craft quality (5 pts.)
No 0 points
Poor 1 points
OK 2 points
Good 3 points
Great 4 points
Excellent 5 points

Objective Photography (11 pts).

Object is photographed on all sides and any important, small details (5 pts.)
No 0 points
Poor 1 points
OK 2 points
Good 3 points
Great 4 points
Excellent 5 points

Lighting of the object is consistent and even. No over- or underexposure (5 pts.)
No 0 points
Poor 1 points
OK 2 points
Good 3 points
Great 4 points
Excellent 5 points

Photos of models submitted online (1 pt.)
Not On-Time or nothing submitted - 0 points
Yes - 1points

Subjective Photography (11 pts.)

Object photography is in context and conveys the closeness word/mood assigned at the beginning (5 pts.)
No 0 points
Poor 1 points
OK 2 points
Good 3 points
Great 4 points
Excellent 5 points

Lighting of the object is consistent and even. No over- or underexposure (5 pts.)

No 0 points
Poor 1 points
OK 2 points
Good 3 points
Great 4 points
Excellent 5 points

Photos of models submitted online (1 pt.)
Not On-Time or nothing submitted - 0 points
Yes - 1points

Final Presentation and Slide Deck (15 pts.)

Presentation is well compiled; images are of good quality, with no pixelation, misspellings, hyphens, or broken grids (5 pts.).
No 0 points
Poor 1 points
OK 2 points
Good 3 points
Great 4 points
Excellent 5 points

Presentation is well-rehearsed. Refained from reading directly from slides, adequate volume for the room (5 pts.).
No 0 points
Poor 1 points
OK 2 points
Good 3 points
Great 4 points
Excellent 5 points

PDF file submitted online (5 pt.)
Not On-Time or nothing submitted - 0 points
Yes - 5 points

Background and Understanding (12 pts. total)

Design Development (72 pts. Total)

Design Implementation (84 pts. Total)

168 possible points (168/168=100)

Appendix 3:
Suggested course timeline for 5.5 weeks of working time

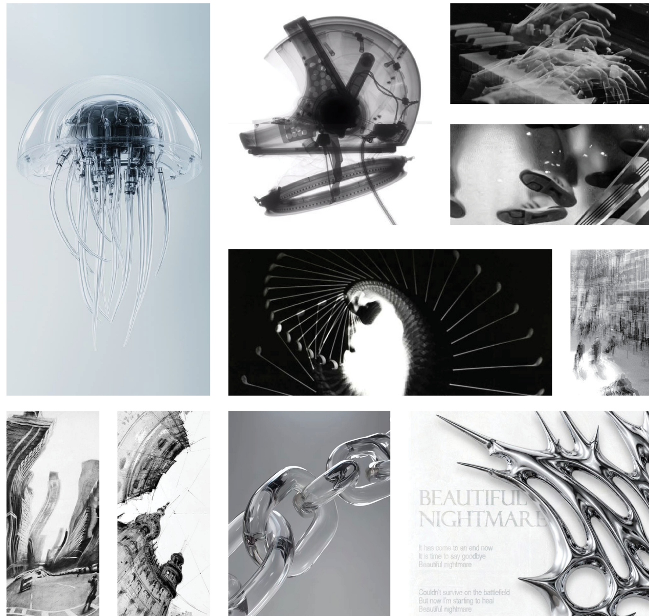
Mock schedule for studio classes with a M/W/F work week

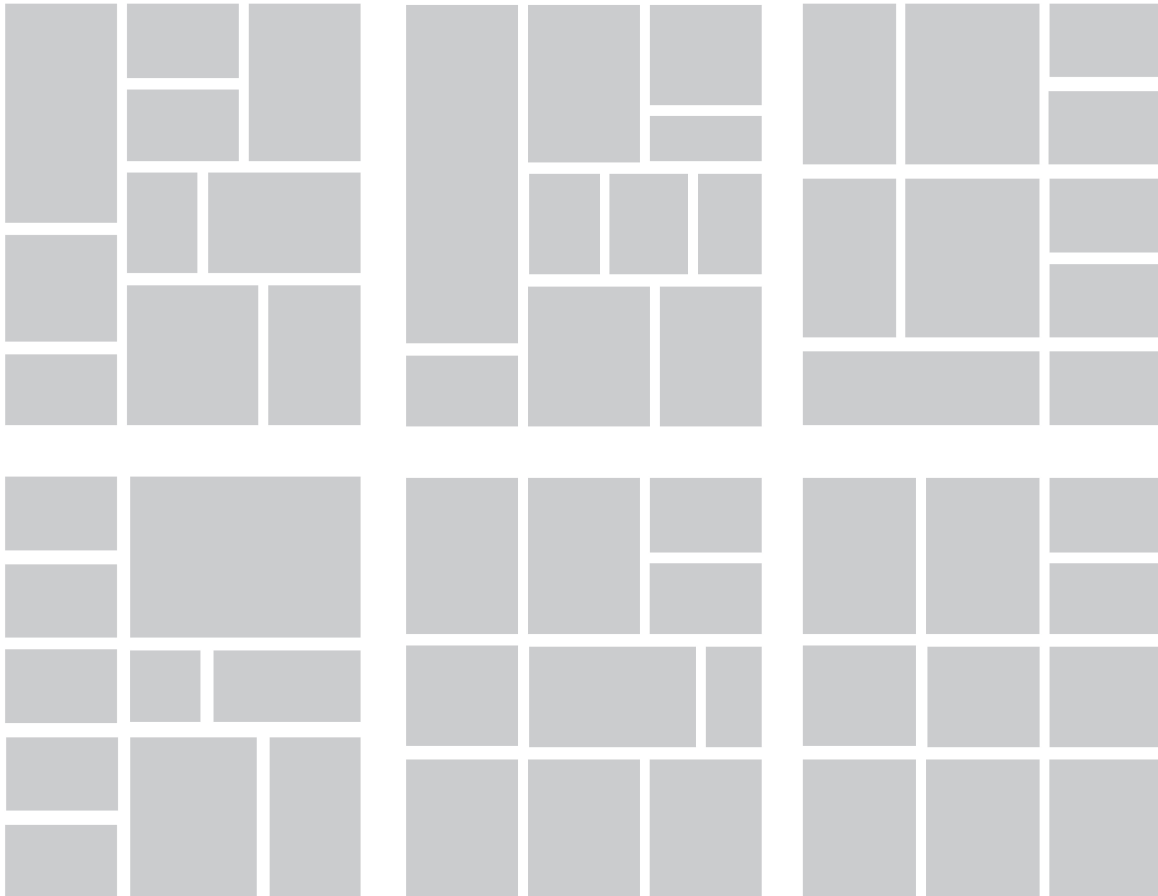
Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
				Pitch Project, Give Words, Demonstrate Moodboard Sturcture	Weekend for gathering images 2-3 hours finding and arranging	Weekend for gathering images 2-3 hours finding and arranging
Critique Moodboards, 1 on 1 with faculty adjust if needed		In Class Gesture Demo, Work day		Critique initial gestures & check for understanding 1 on 1 crit	fix gestures if needed/ more initial gestures if wanted	fix gestures if needed/ more initial gestures if wanted
Check back Intro 2nd round gestures in class		Pin up @ start of class full class semantic crit		full class semantic crit begin/assign renders (3)	fix gestures if needed Rendering	fix gestures if needed Rendering
Check in/ Work day for renders		Pin up @ start of class,Semantic crit 2 directions mock ups		work day modeling	modeling	modeling
Semantic crit @ start of class pick 1 for final		Craft lecture (paint, sanding etc) Work Day		Work Day		
Final Due lecture: photo objective, subjective		Final Presentations		Final Presentations if needed		

Moodboard Construction

To keep the focus on the images' content, it's recommended that the content be arranged in a grid with equal spacing between the alley and the gutter. The moodboard can be constructed in many ways within the limitations proposed.

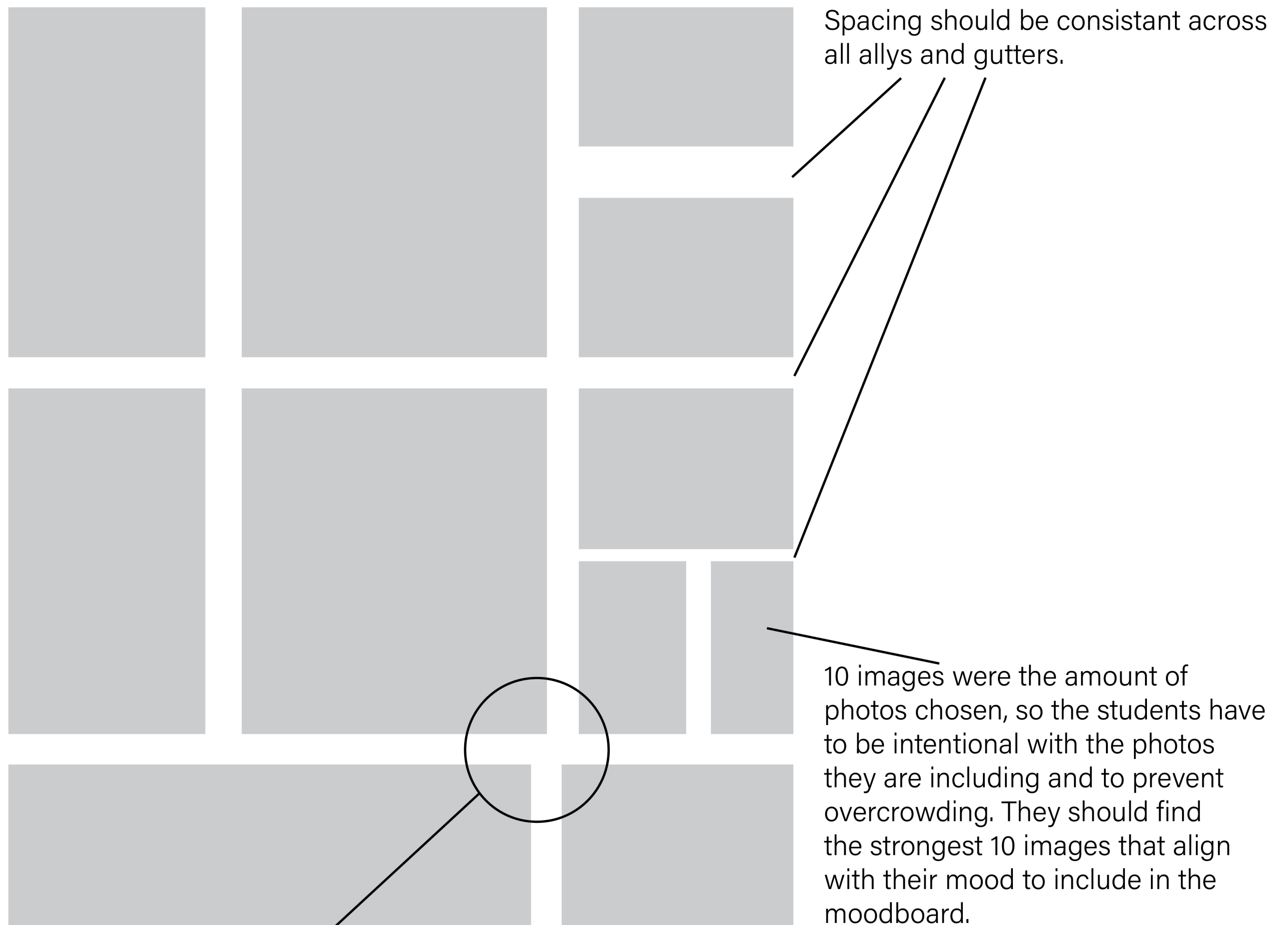
Other tips:
-Remain cautious of corners that are too close to one another (Example on pg 2)
-Students can crop images if needed.
-Ensure images are high resolution.
-Images can be edited to be black and white if needed.
-10 images total.





Example arrangements do not have images; grey examples are for collage compositions and are purposely left blank.

Moodboard
Common Mistakes

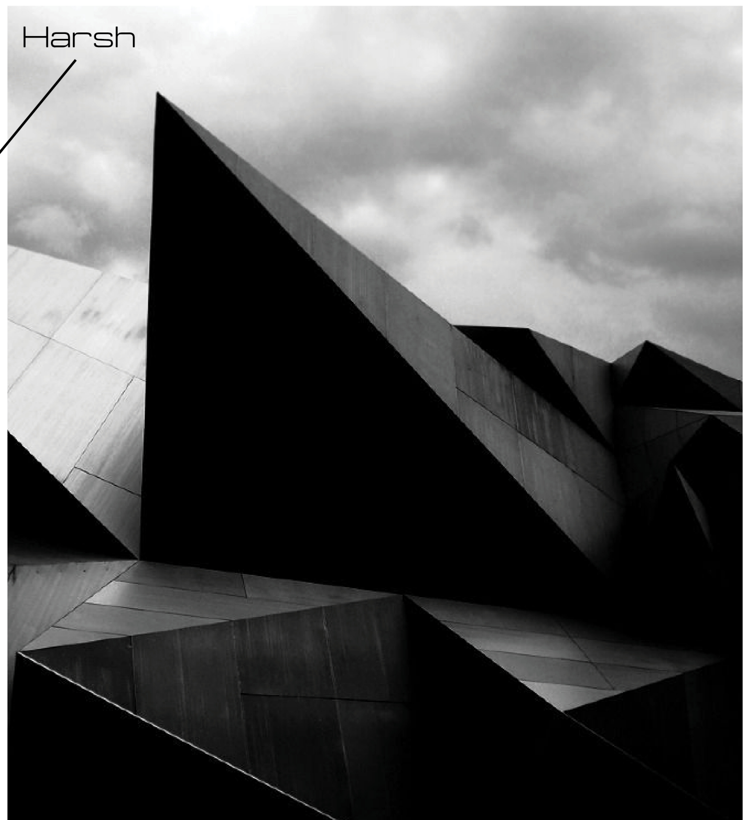


Arrangements where images meet corner to corner like an intersection are alright, however, be cautious of the distance between images that do not perfectly meet at the corner to avoid unnessisary visual tension between images.

Breaking up the grid is okay as long as it is done with intention.

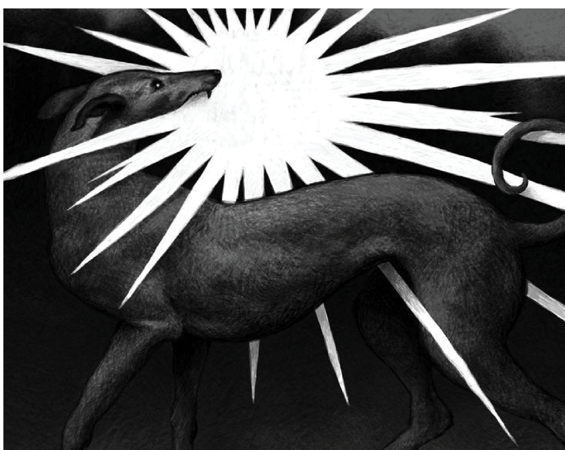
Moodboard Common Mistakes

Moodboards should not include words that are added by the student. If they are present in an overall, graphic-forward work, then it's alright, but the moodboard should not rely on words to directly communicate the mood.



Moodboards should not contain images that are in direct contrast to one another.

If "sharp" is the word, then all the images should work together to convey that, and because there are only 10 final images, a slot should not be wasted on an image that doesn't fit the established mood.



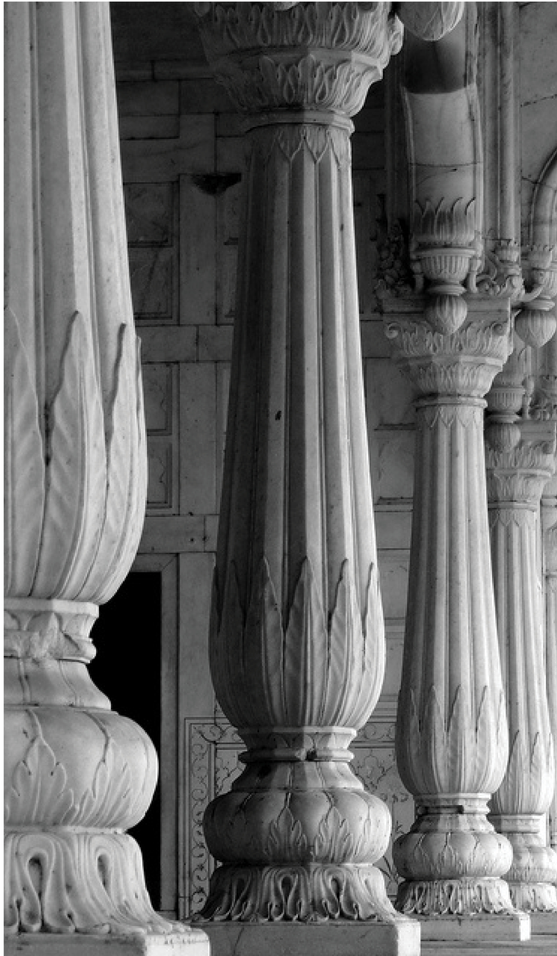
Graphic choices can be harder to abstract, but should not be shied away from, as they often offer valuable insights into visual communication, especially once abstracted.

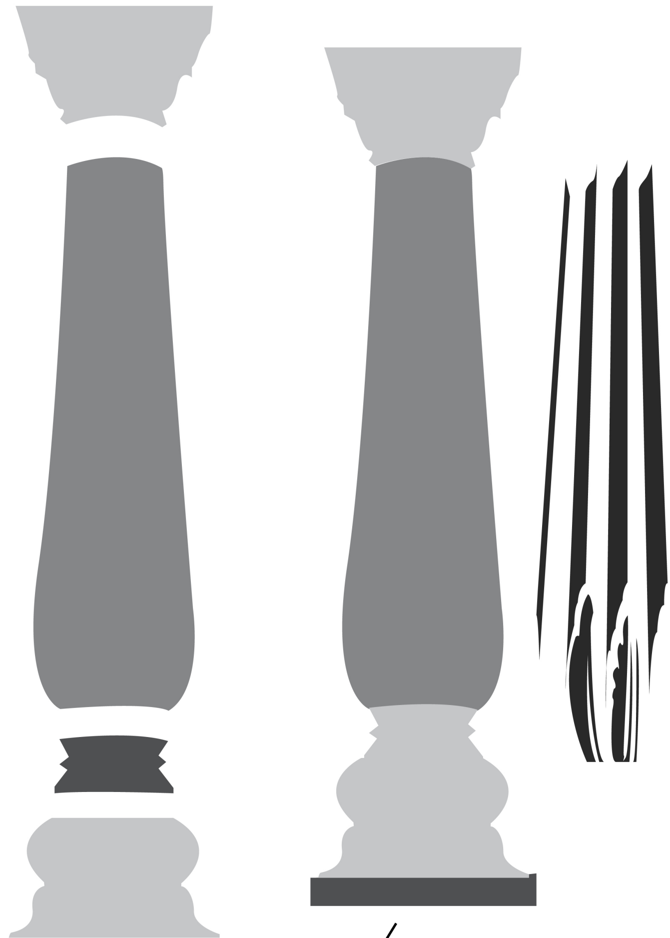
Initial Gesutres

Initial gestures should focus on abstracting the chosen imagery into main components.

Primary, Seconday, and Tertiary.

Or, the evaluation of light and shadow.





Primary

Secondary

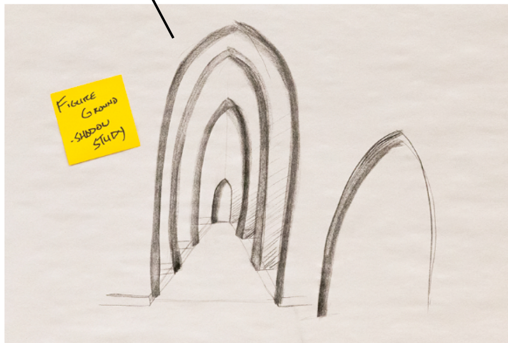
Tertiary

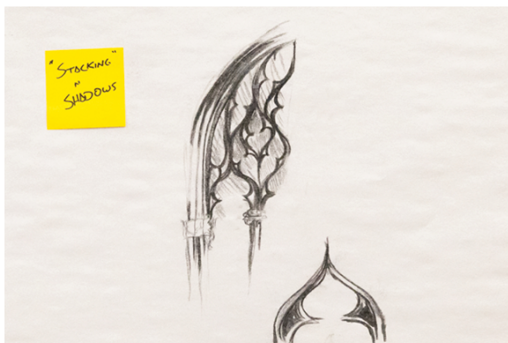
Shadow

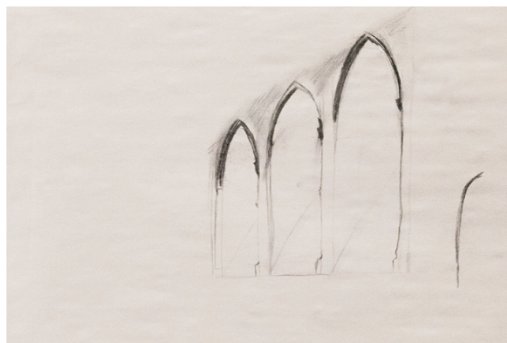
Deconstruction can vary based on the viewer and what's being focused on. In the first deconstruction, the very bottom of the pedestal isn't included. In the second round, the bottom becomes a tertiary feature.

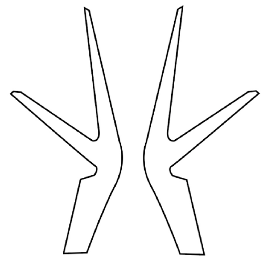
Light and Dark Deconstruction

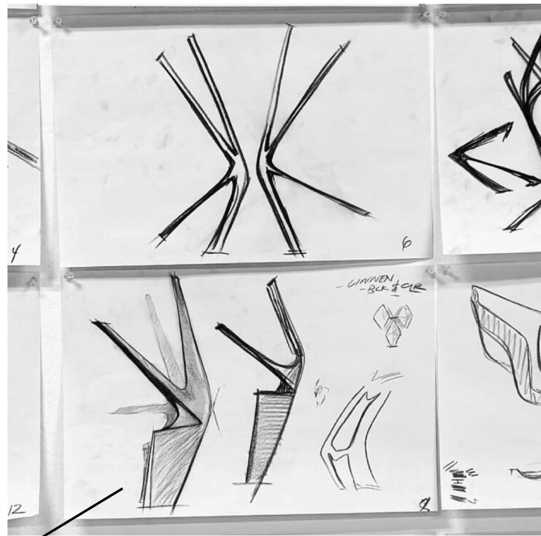
Primary, Secondary, Tertiary Deconstruction











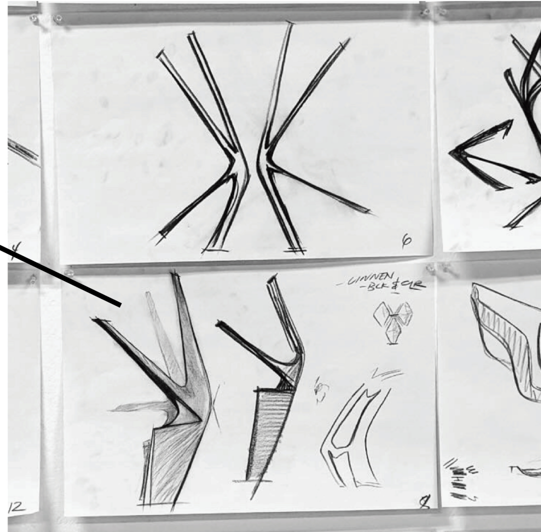
Sketch for Base Understanding

Secondary Gesutres

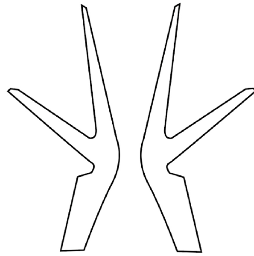
Gestures in this portion are used to loosely begin thinking about how the product will look, while considering lessons from the first round. Here we can see the columns and arches being morphed into clocks, while some initial exploration is still happening, most of these gestures are beginning to look like clocks.

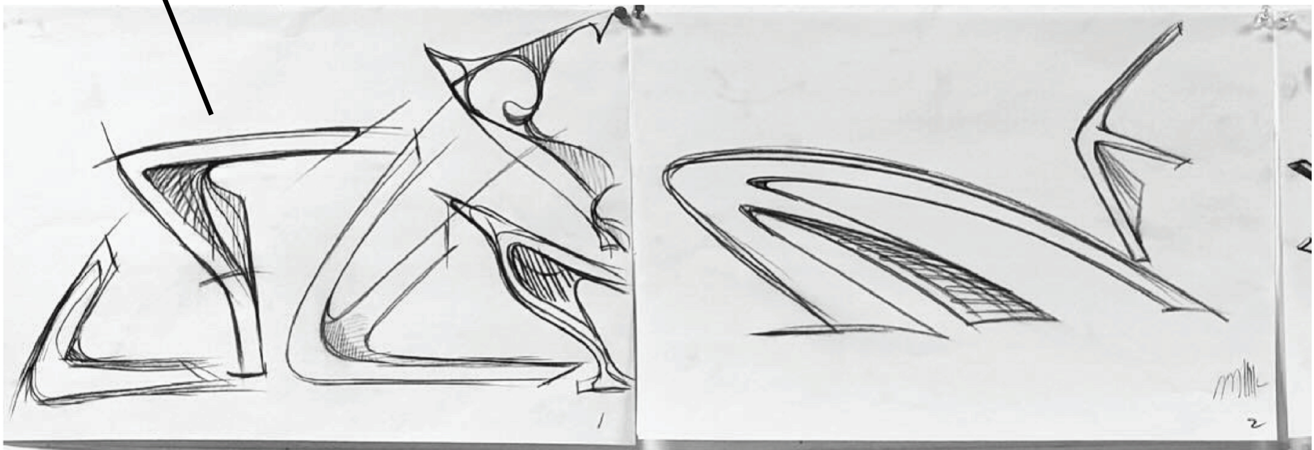
Secondary Gesutres

1st round



2nd round





These secondary gestures, while they aren't iterating towards their intended function (light fixture in this example), are aiming to further abstract the forms established in the initial round of gestures. These second-round gestures aim to push the forms established by the chosen imagery until they go too far and no longer have a visual link to the source material.

While these sketches aren't gestures of a light fixture, they still serve the purpose of a second round gesture within the confines of this thesis.

Objective Photography

Objective photography aims to capture something without bias. This is the object. This is how it looks. These are the parts that make it up. It’s more for documentation than conveying any particular emotion.

It’s evaluated on lighting and image quality, while composition isn’t as heavily weighed.

Subjective Photography

Subjective photos act like ads, they are meant to convey a certain feeling or emotion.

"A photo is worth 1000 words"