

Artistic Thinking and Embodied Cognition

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Abstract

Artistic thinking and Embodied Cognition

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This research explores artistic thinking through the frameworks of embodied cognition and Material Engagement Theory, proposing that the thinking involved in artmaking is an emergent, dynamic process grounded in the interaction of brain, body, materials, and environment. Building on a model developed in previous research, the Artistic Thinking Model (ATM) is further elaborated and refined through participant-based research with professional artist-teachers.

The study conceptualizes the artmaking process as a dynamic system composed of interconnected elements: the artist, the artmaking subject, the materials, and the emerging artwork. Each element contributes affordances that structure the action-perception cycles underlying artistic cognition. The ATM identifies three complementary and reciprocal modes of embodied thinking within this system: visual, material, and qualitative thinking, which collectively support the construction of meaning in the material process of artmaking.

Through detailed analysis of participant artmaking processes, the research demonstrates how material affordances, extended cognition, enactive sense-making, and qualitative experience are woven together in the evolution of an artwork. The findings offer a model for understanding artistic thinking as a situated, embodied, and materially engaged process of meaning construction.

The study's contributions extend both theoretical and pedagogical knowledge. It provides a framework for analyzing artistic cognition in studio practice and a method for developing pedagogical content that supports the reflective and embodied aspects of artistic learning. The research affirms the importance of recognizing artmaking as an emergent, dynamic, and materially grounded form of thinking, offering new insights into the nature of creativity, embodiment, and education in the arts.

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Dedication

For Nataša and Pierre, who have given me their constant support and love, without which I could not have seen this project to its end, and to my dad who always wanted me to see my projects to the end.

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Chapter 1. Introduction

“There has been almost a conspiracy of silence among artists concerning the arduous training and the keen mental efforts involved in artistic practice. Just why this has been so is a difficult matter to assay, but, in any case, most artists have hesitated to acknowledge the cognitive dimensions and demands of their chosen field.” (Gardner, 1983, p. 47)

There is a persistent tendency in visual arts education to separate theory from practice, conceptual ideas from technical abilities, and meaning construction from material processes. One reason for these enduring dichotomies lies in longstanding beliefs about where and how thinking happens, and how knowledge should be represented.

These problems are not new. They can be traced back to Aristotelian distinctions between episteme (knowledge) and techne (craft) (Richard, 2024). The tension between theory and practice has historically positioned skill acquisition as less valuable than knowledge acquisition. Skills-based learning has often been regarded as non-intellectual and thus marginalized. One need only look at art history to see that methods of production were rarely documented, as manual labor was considered inferior (Quiviger, 2002). This devaluation of material process remains a contentious issue today, where the social, cultural, and historical contexts of artworks are often prioritized over the material processes of their creation (Moore, 2010; Schatzki, 2001; Abrahamson & Lindgren, 2014).

Since the Renaissance, artistic creativity has been believed to originate in the mind, where ideas and concepts are formed and then imposed onto passive matter (Lehmann, 2012, p. 11). This hylomorphic reasoning, separating ideas from their realization in materials, has created a critical disequilibrium in how art is represented and taught (Ingold, 2013; McGuirk, 2012). Some scholars warn that neglecting the role of the body and materials risks erasing the foundations of artmaking from visual arts curricula (Breitfeller, 2010; Singerman, 2012; Chorpening, 2014). In response, the last two decades have seen a growing interest in tacit knowledge within art education. Tacit knowledge, embedded in embodied skills and often difficult to articulate verbally, is particularly relevant for understanding how knowledge is transferred in art education (Barrett, 2007; Nimkulrat et al., 2016). Researchers argue that

greater attention to tacit processes could lead to more comprehensive and effective teaching methods (Dorn, 1999; Jarvis, 2007).

Yet, as Elkins (2009) notes, truly understanding the studio classroom requires "addressing the day-to-day experience of making – its exact pedagogy, its methods, knacks and skills, its feel...rather than ways of conceptualizing the product of the experience." (p. 246). Scholars such as Hickman and Kiss (2013) and Whelan et al (2017) have proposed that articulating the cognitive and tacit dimensions of artmaking could support new methods of practice-based assessment. Although recent studies have examined pedagogical methods in art schools (Orr & Shreeve, 2018; Sawyer, 2018; Newall, 2019), research into how material processes are actually taught remains limited, partly because tacit knowledge is perceived as ambiguous and difficult to codify (Orr & Shreeve, 2018).

Addressing tacit knowledge inevitably brings us back to the broader issue of how knowledge itself is defined, and what is included, or excluded, as a cognitive process. Western philosophy's long-standing devaluation of the body's role in knowledge representation reached a peak with classical cognitive science and its computational theories of mind (Lakoff, 2018). Symbolic models of cognition reinforced a dualistic knowledge hierarchy, privileging explicit, linguistic reasoning over perception and action. In education, this hierarchy has marginalized sensory-motor and material-based skills (Abrahamson & Lindgren, 2014; Reid & Mgombelo, 2015; Penny, 2019). Within the visual arts, this has led to the persistent undervaluation of embodied, material processes. Calling these skills tacit knowledge has not fundamentally changed the situation, nor has it illuminated the nature of these hidden forms of knowledge.

How we define knowledge, and what we recognize as cognitive processes, profoundly shapes what and how we teach in art education. If we adopt a perspective that unifies mind and body, the knowledge of artistic practice appears quite different: thinking, perceiving, and acting are synthesized into a continuous process. Emerging theories of embodied cognition offer precisely this holistic perspective, resituating perception, action, and thought within a dynamic loop of bodily engagement with the world.

This research responds to these challenges by investigating artistic thinking through the lens of embodied cognition and material engagement. It builds upon my previous work in art education (Marinkovic, 2011, 2021), which explored how arts-based research could create a dialogue between painting and teaching practices. Using tacit knowledge as a theoretical

framework, my master's research examined how thinking is enacted through painting and transferred into teaching, resulting in the development of an Artistic Thinking Model (ATM).

The ATM identifies three interrelated categories of thinking; visual, material, and qualitative thinking, which have historically been considered separately in the visual arts. By synthesizing them into a unified model, the ATM offers a novel framework for understanding the dynamic interplay of mind, body, and materials in artistic processes. When situated within an embodied cognition framework, the ATM becomes a method for identifying and analyzing how thinking is enacted through artistic practice. Building on this foundation, the present research seeks to deepen the theoretical underpinnings of the ATM by integrating insights from embodied cognition and Material Engagement Theory (Malafouris, 2013). Through this lens, the ATM functions not only as a descriptive model but also as an analytical tool for understanding how thinking dynamically emerges through material engagement.

The research is guided by the following questions:

1. *What is the relationship between thinking and action in the material processes of artists?*
2. *How can the Artistic Thinking Model serve as a method for analyzing the material process of artmaking?*

This is a qualitative research study that employs a multiple-case study framework to explore the relationship between thinking and action through the practices of five professional artist-teachers. Methods include practice-based research, cognitive task analysis, interviews, and video recordings of artistic processes.

The literature review begins by exploring the concept of artistic thinking within art education and examining pedagogical practices in post-secondary art institutions. This is followed by an overview of the Artistic Thinking Model. The theoretical framework then surveys embodied cognition and Material Engagement Theory. The findings, presented across six chapters, progressively build the relationship between the ATM, theoretical insights, and the participants' contributions. Through detailed analysis of participant artmaking processes, the research demonstrates how embodied cognition and individual experience intertwine in the evolution of the artwork, ultimately proposing a dynamic model for understanding artistic thinking as a situated, embodied, and materially engaged process of meaning construction. By weaving together embodied cognition, material engagement, and artistic practice, this research

offers a dynamic rethinking of how artistic thinking is conceptualized and how it can be taught. In doing so, it contributes to a growing discourse that seeks to reunite mind, body, and material processes at the heart of art education.

Chapter 2. Literature Review: Artistic Thinking

What is artistic thinking?

From the perspective of cognitive psychology, thinking refers to how we process information, encompassing abilities such as perception, memory, concept formation, problem solving, and various methods of reasoning. When we qualify thinking as *artistic*, we imply that there are particular or distinguishing features that set it apart from other forms of cognition. Identifying these features can inform more effective approaches to teaching and learning in the arts (Holyoak & Morrison, 2012; Friedenberg et al., 2022).

Qualifying thinking as artistic can imply different things. It may refer to how cognition functions in the context of artistic practice or suggest that there is a distinct form of cognition specific to the arts. The aim of this literature review is to situate this inquiry within the broader field of art education and to propose a working definition of artistic thinking that can guide both theoretical and pedagogical frameworks.

Artistic Thinking and Art Education

In the first half of the twentieth century, art education emphasized creative self-expression rooted in emotion and intuition. This philosophy, central to the child art movement initiated by Franz Cizek in Vienna, and later developed in North America by Viktor Lowenfeld, drew upon Romantic ideals of creativity as an innate human capacity (Smith, 1989). According to this view, art learning should be nurtured through freedom and exploration, with minimal instructional interference. As Lowenfeld argued, “the teacher should know that the child must develop his own technique and that every ‘help’ from the teacher in showing the child a ‘correct’ technique would only mean restricting the child's individual approach” (Lowenfeld, 1949, p. 3).

In the latter half of the twentieth century, the cognitive revolution ushered in new perspectives on the role of thinking in all domains, including the arts. By the early twenty-first century, a growing number of publications addressed the intersections of art and cognition. This literature review explores the contributions of Arthur Efland, Elliot Eisner, and Howard Gardner (in conjunction with Harvard's Project Zero) to establish how artistic thinking has been conceptualized within this evolving discourse.

Arthur Efland: Art and Cognition

In *Art and Cognition* (2002), Efland provides a comprehensive and critical review of the evolving relationship between cognition and art education throughout the twentieth century. He argues that art and cognition have historically maintained an uneasy relationship. Art was long regarded as an emotional endeavor, and because emotions were traditionally viewed as outside the scope of rational thought, they were considered non-cognitive. Even as cognitive science began to incorporate emotion into models of reasoning, this shift did little to enhance the cognitive legitimacy of the arts.

Efland attributes this to a limited understanding of how art contributes to cognitive development and a lack of pedagogical tools to teach or assess such development. Additionally, the mind-body dualism embedded in computational theories of mind and early cognitive science posed significant challenges for understanding the embodied and interpretive nature of artmaking.

Efland's response is grounded in a key distinction between *well-structured* and *ill-structured* domains of knowledge. Disciplines such as mathematics and science are well-structured, relying on hierarchical knowledge and rule-based problem solving that yield right or wrong answers. The arts, by contrast, operate within ill-structured domains, which demand interpretation, flexible thinking, and the capacity to navigate ambiguity. In this context, Efland highlights four critical features of cognitive development in the arts: cognitive flexibility, integration of knowledge, imagination, and aesthetic encounters.

Cognitive Flexibility: Cognitive flexibility is the capacity to adopt a range of strategies based on the demands of a given problem. In ill-structured domains like the arts, rule-based thinking is insufficient; rather, learners must cultivate a repertoire of interpretive approaches. Efland proposes that learning through case studies promotes this adaptability and supports knowledge transfer by encouraging learners to apply prior knowledge to novel contexts.

Integration of Knowledge: Efland contends that the purpose of teaching the arts is not to prepare students for professional careers in fine arts, but to foster understanding of the broader social and cultural landscapes they inhabit. Artistic thinking promotes interdisciplinary learning by integrating knowledge from diverse fields. Artworks serve as cognitive landmarks, sites where historical, cultural, and social meanings converge, allowing learners to synthesize and contextualize knowledge.

Imagination: For Efland, imagination is a vital aspect of cognition. Unlike the sciences, where metaphor often operates unconsciously, the arts make the imaginative process explicit and open to inquiry. He draws on Lakoff and Johnson's (1980) conceptual metaphor theory to argue that imagination, metaphor, and narrative play central roles in concept development and meaning making. These imaginative processes enable individuals to understand socio-cultural contexts and contribute to rational thought by expanding cognitive representations beyond literal experience.

Aesthetic Encounters: Efland argues that aesthetic experience is inherently cognitive because cognition begins with perception, just as the experience of an artwork does. Aligning with Nelson Goodman's view that art is a form of symbol-based cognition, Efland agrees that art constructs meaning. However, he critiques Goodman's notion of "multiple literacies," where each medium requires a distinct cognitive approach. Efland sees this as a barrier to integrative learning across disciplines. Instead, he emphasizes the need to understand artworks as cultural landmarks that deepen our comprehension of diverse contexts and support broader cognitive development.

Elliot Eisner: Arts and the Creation of Mind

In *Arts and the Creation of Mind*, Eisner (2002) presents a rich and nuanced perspective on how cognition develops through artmaking, emphasizing the roles of both teachers and learners. He explores key aspects of art education, including curriculum design, assessment, and educational research. Eisner argues that the value of the arts should be recognized for their intrinsic contributions to human development, rather than being justified on extra-artistic grounds, such as their potential to enhance performance in other academic subjects. Eisner outlines three central contributions that art education makes to learning:

- Non-verbal forms of communication and expressive methods.
- Development of thinking through perception and creative practice.
- Fostering of aesthetic experiences as meaningful, embodied encounters.

A key theme in Eisner's work is the non-verbal nature of meaning-making in the arts, which he describes through three types of formal representation:

1. Mimetic forms, which resemble what they represent.

2. Expressive forms, which involve the treatment and composition of materials.
3. Conventional signs or iconography, where forms acquire symbolic meaning.

The concept of qualitative thinking, deeply influenced by Dewey, permeates Eisner's writings. For Eisner, qualitative thinking arises from our direct experiences of the world and the diversity of emotional and perceptual reactions they elicit. Aesthetic experiences are a subset of these qualitative experiences and are not limited to encounters with traditional artworks. Eisner argues that the ability to distill such experiences into creative forms is a mark of qualitative intelligence. In the context of artmaking, this kind of thinking involves cultivating sensibility and judgment, rather than following prescriptive rules. Eisner also describes artmaking as a process that unfolds across several cognitive stages, including:

- The qualitative perception of the world through sensory and emotional experience.
- The framing of an idea or issue to be addressed.
- The creation of an imaginative vehicle for realizing that idea.
- The acquisition and application of technical skills appropriate to the affordances and constraints of the chosen material.

Throughout the book, Eisner repeatedly refers to the affordances and constraints of materials, highlighting their central role in shaping thought and expression. This aspect of his theory points toward Gibson's (2015/1979) ecological psychology, suggesting that materials both limit and enable particular forms of meaning-making. In Eisner's view, artistic ability is not a product of natural maturation, but rather something that must be cultivated. Teachers play a critical role in helping students engage with materials, learn their possibilities, and develop the skills needed for expressive communication.

Bridging Efland and Eisner: While Efland focuses on the concept of ill-structured knowledge in the arts, Eisner gestures toward a similar idea through concepts like *flexible purposes* and the *open-ended outcomes* of artmaking understood as a form of inquiry. These notions anticipate ideas Eisner would later expand upon in his writing on arts-based research (Barone & Eisner, 2012).

Discipline-Based Art Education (DBAE): Discipline-Based Art Education is a curriculum structure promoted by Eisner in conjunction with the Getty Institute. Although DBAE is no longer actively promoted in current art education literature, its legacy persists in certain educational

practices (Bertling & Moore, 2021). While Eisner does not explicitly address DBAE in *Arts and the Creation of Mind*, it is relevant to discussions of art and cognition because it reflects a structured approach to learning in the arts. DBAE encouraged a curriculum built around four interrelated disciplines: art history, aesthetics, artistic production, and art criticism. Eisner argued that these represent the primary ways art functions within diverse cultural contexts (Eisner, 1988).

Gardner, Project Zero, and Cognition in Art Education.

Howard Gardner, along with Nelson Goodman, launched Project Zero at Harvard University in the late 1960s to explore the relationship between the arts and cognition. Drawing on Goodman's (1976) work on symbol systems, Project Zero sought to shift the focus of art education away from traditional associations with emotion, mystery, and intuition, and toward the cognitive dimensions of symbolic thinking and problem-solving. Artistic thinking, under this framework, was interpreted through the lens of classical cognitive science, which viewed cognition primarily as symbol manipulation. From this standpoint, an accomplished artist was seen as someone literate in the symbolic systems of art, with emotions serving to support, but not drive, cognitive functions. (Gardner, 2006)

In the 1970s, Project Zero evolved into Arts PROPEL, which placed greater emphasis on psychological experimentation in art education. While distancing itself from the more rigid structure of Discipline-Based Art Education (DBAE), Arts PROPEL emphasized artistic production as the central component of curriculum design. Gardner (2006) proposed that education in the arts should be structured around three core competencies:

- Production – the making of art.
- Perception – the ability to notice and interpret artistic qualities.
- Reflection – the capacity to evaluate and make meaning from one's artistic experiences.

These competencies were intended to be integrated into project-based learning, with art history, criticism, and aesthetics positioned in support of production. This orientation marked a philosophical departure from DBAE, which treated those components as more discrete disciplines.

Gardner advocated for a spiral curriculum in art education. Rather than a fixed sequence of concepts taught hierarchically by age, the spiral model promotes revisiting key ideas across different stages of learning, allowing for increasing depth and complexity over time. He also emphasized the importance of domain-specific assessment, arguing that evaluations should be grounded in the particular art form, what he calls the "intelligence" relevant to that discipline (Gardner, 2006).

For Gardner, the central aim of education is understanding, which he defines as "the capacity to take knowledge, skills, concepts, facts learned in one context, usually the school context, and use that knowledge in a new context, in a place where you haven't been forewarned to make use of that knowledge" (Gardner, 2006, p. 133). In essence, understanding is the ability to transfer knowledge across domains and contexts. This emphasis on transfer became a foundation for the Studio Thinking framework, a later research initiative at Harvard that operationalized these ideas into a model for teaching studio habits of mind. Gardner also emphasized the collaborative nature of art education, arguing that it should be "a cooperative enterprise involving artists, teachers, administrators, researchers, and the students themselves" (Gardner, 1989, p. 77).

Studio Thinking.

The Studio Thinking framework (Hetland et al, 2015) began as a critical inquiry into claims that students who engaged in arts education achieved better outcomes in other areas of learning. This was a common argument used to advocate for art education within schools. After a systematic inquiry, the researchers from Project Zero stated that the research could at best demonstrate correlation but not causation. The Studio Thinking research program was designed to determine what types of thinking are developed in art education by studying teachers and students in secondary schools having a strong focus in the arts. The research resulted in the Studio Thinking framework which comprises a general curriculum structure, and a dedicated group of thinking abilities called studio habits of mind. The studio structures for learning are a general teaching framework that consists of demonstration lectures, creation, critique and exhibition.

The authors characterise the studio habits of mind as thinking dispositions. A thinking disposition refers to both the ability to do something and the ongoing application of knowledge. According to Tishman & Perkins (1993) the difference between a skill and a disposition is the difference between knowing something versus effectively using that knowledge. For example,

knowing how to draw is not the same as someone who draws on a regular basis. In other words, developing a disposition relates to the ongoing use and application of knowledge abilities. The studio habits of mind include the following thinking dispositions:

- **Develop craft:** Learning technical and material techniques.
- **Engage and persist:** The ability to engage in artistic problem solving.
- **Envision:** The use of imagination to create and project ideas.
- **Express:** Learning how to communicate ideas and experiences through art.
- **Observe:** Learning how to pay attention to surroundings.
- **Reflect:** The ability to reflect on personal work (metacognition) and the work of others.
- **Stretch and explore:** the ability to take risks and move beyond one's current understandings.
- **Understand art worlds:** integrate art history and contemporary artistic production into learning.

The authors claim that by learning art, students learn habits of mind that are not the focus in other areas of learning. These are abilities that are important in other fields and yet are ignored. These skills include visual-spatial abilities, reflection, experimentation and self-criticism. The Studio Thinking framework (Hetland et al, 2015) places the focus on artistic production and offers teachers a means of building connections between thinking, action and art-making outcomes. The list of thinking dispositions appears straightforward, applicable and may serve to guide educators for assessment purposes.

Individual Creativity.

While creativity was not a central theme in the work of Efland (2002), Eisner (2002), Gardner (1989, 2006), or the Studio Thinking (Hetland et al, 2015) researchers, Buschkühle (2019) argues that *individual creativity* is the core concern of artistic learning. Drawing on Joseph Beuys' well-known assertion that 'everyone is an artist', Buschkühle emphasizes that creative acts are accessible to all. Although he aligns artistic thinking with creative activity, Buschkühle maintains that the two are not synonymous. In his view, artistic thinking consists of five key elements: sensitive perception, personal imagination, critical reflection, quality of will, and manual skills. These capacities reflect an embodied and intentional engagement with the world through artistic practice. In addition to these core elements, Buschkühle identifies essential pedagogical components of artistic education. These include experimentation, project-based learning, social learning, and interdisciplinary approaches that integrate art history,

contemporary media, and socio-cultural knowledge. Together, these practices support the development of creative agency and foster the growth of an artistically engaged learner.

Discussion.

The relationship between cognition and art education, as presented by each of the theorists reviewed, reflects their respective views on the educational objectives of the arts. For Efland (2002), the primary aim of art education is to foster socio-cultural understanding. This perspective aligns with an *education through art* approach, wherein art serves as a medium for developing competencies and insights that extend beyond the discipline itself (Houghton, 2017). Efland devotes relatively little attention to the material processes of artmaking in his cognitive framework. In contrast, Eisner fully embraces material engagement, positioning it as central to distinctive forms of thinking cultivated in the arts. He argues that artistic processes foster unique cognitive abilities, ones not readily developed elsewhere in the curriculum. Eisner's emphasis on embodied learning and expressive production aligns more closely with an *education in art* approach (Houghton, 2017).

Research emerging from Harvard, including Gardner's (1989, 2006) work, Project Zero, and the Studio Thinking framework (Hetland et al, 2015) centers on the development of cognitive dispositions that support the transfer of knowledge across contexts. These models demonstrate how thinking skills cultivated in the arts (such as reflection, problem-solving, and imagination) can be applied both within and beyond the classroom. The focus on transferable skills reflects a pragmatic and interdisciplinary vision for the role of art education in broader cognitive development.

The continued popularity of the Studio Thinking framework (Hetland et al, 2015), evidenced by its multiple editions and widespread use, suggests a growing demand for structured approaches to teaching art. It also reflects sustained interest in articulating the cognitive dimensions of studio practice in ways that are accessible and assessable within school settings. Recent studies, such as the systematic review by Samaniego et al. (2024), affirm that educational frameworks centering on creativity and cognition in the arts continue to gain traction, aligning with the core principles of both the Studio Thinking framework and arts-based cognitive development more broadly. The following section will shift focus to post-secondary contexts to explore how artistic thinking is manifested in higher-level pedagogies.

Art School Pedagogy: Values, Beliefs, and Methods

Over the past two decades, both visual arts and art education have undergone significant transformations in their teaching philosophies and pedagogical practices. While art education sought to legitimize its presence within general education, emphasizing structured learning outcomes and curricular frameworks (Eisner, 2000; Hetland et al, 2015), the art school faced a different challenge: how to articulate its pedagogical values and methods in relation to the legacy of the traditional art academy.

Seminal texts by Singerman (1999) and Elkins (2001) have framed much of the contemporary discourse on art school pedagogy. Singerman (1999) argues that the integration of visual arts into the university led to a transformation in which art remodelled itself as a discipline aligned with academic norms. This shift resulted in the scientization of practice, where artmaking was reimagined through the language of experimentation, progress, and problem-solving. Consequently, traditional artistic training, with its emphasis on manual skill and apprenticeship, was displaced by a new emphasis on the development of the artist's intellectual and discursive identity. As Singerman notes, the rise of critical theory and institutional critique repositioned the artist as a self-aware agent situated within a network of curators, galleries, and museums. In this shift, the manual and technical dimensions of practice were increasingly devalued in favour of conceptual sophistication.

In contrast, Elkins (2001) interrogates the very possibility of teaching art within institutional frameworks. He contends that art school pedagogy is often incoherent and opaque, functioning under the vague assumption that something beyond technique is being taught. Yet, as Elkins emphasizes, it remains unclear when, how, or even whether meaningful teaching occurs in studio classrooms. He concludes that art instruction is shrouded in mystery and warns against reforming the curriculum without first critically examining the nature of its practices.

In response to these critiques, more recent scholarship has sought to demystify the structure and values of art school teaching. Central to these discussions are unresolved questions:

- What are the pedagogical objectives of the art school?
- What role should technical skill play in a post-conceptual art landscape?
- How can creative development be supported and evaluated?

- And to what extent does studio pedagogy align with—or resist—dominant models of learning and knowledge transmission?

These debates reflect the contested epistemic position of the art school, where embodied, processual, and experiential ways of knowing often challenge academic norms that favour codified, outcome-driven instruction (Barrett, 2007). As a result, art school pedagogy occupies a liminal space between tacit artistic traditions and institutionalized academic demands, making it a uniquely rich but fraught site of cognitive and creative inquiry.

Curriculum Structures in Art and Design Pedagogy

According to Orr and Shreeve (2018), the art school curriculum integrates ways of thinking, acting, and being, with the overarching goal of cultivating an artistic identity. They describe it as a “sticky curriculum”—one that is immersive, tacit, and often resistant to linear sequencing. This curriculum is shaped by two pedagogical modes: signature pedagogies and pedagogies of ambiguity.

Signature pedagogies refer to the distinctive and recognizable teaching methods used in art and design education. These include the studio model, project-based and material-based learning, project briefs, iterative research and development, dialogic exchanges, and evaluative critiques (or crits). These methods serve to structure learning around practice, making process and dialogue central to the development of artistic work. In contrast, pedagogies of ambiguity rely on unorthodox and fluid learning processes, such as invisible teaching, unseen learning outcomes, fluid roles between teacher and student, polyglossia, and what Orr and Shreeve call transparent opacity. These pedagogies acknowledge that much of the most meaningful learning in art school happens implicitly, through participation, making, and interpersonal exchange, rather than through clearly stated objectives.

The studio plays a central role as the physical and social environment in which project-based learning unfolds. It supports a constructivist and constructionist learning model, where material engagement becomes a key mode of knowledge construction. Projects are often structured around briefs that outline broad objectives, which students realize through research, experimentation, and sustained interaction with materials. Teaching in this context follows a student-centered, constructivist philosophy, grounded in experiential learning and collaborative dialogue. Instruction often emerges spontaneously, in response to students’ evolving needs and interests. This results in polyglossic communication, where verbal explanations are combined

with non-verbal demonstrations, tacit cues, and gestures. Compared to the clearly structured and outcome-driven format of traditional university lectures, this style of teaching can appear invisible, even elusive.

Moreover, the open-ended nature of project-based learning and assessment means that learning outcomes are not always predetermined, nor easily articulated in advance. These unforeseen outcomes challenge conventional expectations of transparency and measurability in curriculum design. As noted by Newall (2019) and Matthews (2019), this has led to tensions between faculty, who embrace the ambiguity of the creative process, and administrators, who seek clarity and accountability through standardized learning metrics.

Philosophy of the Art School: Newall

According to Newall (2019), the objective of art school pedagogy is for students to develop an artistic practice that ultimately results in original contributions to the field. The art school curriculum is structured around three core components: the masterclass, art theory, and the crit. Each of these is shaped by two essential factors: how art and creativity are conceptualized. Newall proposes that contemporary artists must develop their own concept of art. To practice or teach art, an individual must possess both a concept of art and the ability to produce work that aligns with it. A personal concept of art typically includes the properties of content, formal elements, style, medium, and techniques.

Newall connects Elkins' (2001) foundational question of whether art can be taught, to Kantian philosophy, particularly Kant's views on originality and creativity. He distinguishes between psychological creativity and historical creativity, drawing on Boden's (2004) work. Psychological creativity refers to personal, individual creative breakthroughs, based on the belief that everyone is capable of creativity. In contrast, historical creativity refers to innovations that transform a field, such as Picasso and Braque's development of Cubism and its influence on twentieth-century art. Newall concludes that the central aim of art school pedagogy is to guide students toward historical creativity. Following Kant's view that creativity cannot be reduced to a formula, Newall argues that creativity should not be directly taught, as doing so would contradict its very nature. Instead, it is fostered indirectly through the values and structures of the art school. He identifies three curricular structures as central to this aim: the masterclass, art theory, and the crit.

The masterclass, derived from the 19th-century atelier tradition, involves students working under the guidance of a specific artist-teacher, who conveys their own concept of art. Grounded in constructivist learning philosophies, the teacher creates a supportive environment for exploration, experimentation, and risk-taking. These methods aim to help students develop original interpretations of artistic concepts. The art theory component helps students develop the rationale for their artistic choices within the contemporary art world. Studying theory enables them to conceptualize their practice and position their work within a broader and more complex cultural and historical context. As de Souza (2018, p. 53) notes, contemporary artists are increasingly expected to function as “public intellectuals” and can no longer afford to cling to outdated notions of the artist as inarticulate or insist that the visual alone should suffice.

According to Newall, the crit is distinctive in that it relies on the collective response of a group, rather than the evaluation of a single teacher. At its best, the crit reaches a form of consensus about a student’s practice, offering feedback that supports the further development of their personal concept of art. While acknowledging the problematic history of crits, Newall argues that they should be further theorized and critically understood in order to enhance their effectiveness.

Creativity and Pedagogical Methods: Sawyer

Sawyer (2018) examined the relationship between pedagogical methods and creativity by studying the instructional practices of professors in American schools of art and design. His research explored multiple conceptions of creativity—as a personality trait, as self-expression, as a burst of insight, and as a process-oriented phenomenon.

Creativity as a personality trait assumes that creativity is an innate potential within the student, which education should help develop. Creativity as self-expression is grounded in the idea that creative ability is located in the subconscious and can be accessed by helping students discover their inner voice. Creativity as insight involves sudden cognitive restructuring or “aha” moments, which can be fostered through divergent thinking and ideation techniques. Process-oriented creativity, in contrast, views creativity as unfolding through sustained engagement and iterative making. Sawyer found that pedagogical practices and learning outcomes in the institutions he studied were predominantly aligned with a process-oriented view of creativity, characterized by the following features:

- Artmaking and design are iterative, open-ended, and non-linear processes.

- Discipline-specific skills and knowledge are developed through ongoing engagement with creative practice.
- The creative process is scaffolded through instructors' observation of, and response to, student work.
- Skills, techniques, and materials are integral—not just as tools, but as generative components of ideation.

In these classrooms, pedagogy was typically organized around project-based learning with the goal of developing a mastery of the creative process. Projects were often framed by open-ended questions, and instructors introduced constraints to help structure experimentation and focus inquiry. Students engaged in experiential, situated learning were encouraged to reflect critically on their work and to articulate their intentions. Notably, professors tended to avoid direct judgments about aesthetic quality. Instead, they emphasized the deliberative and developmental aspects of the creative process

Summary of art school pedagogy

The review of art-school pedagogy provides a general understanding of the teaching methods that are used to structure the curriculum in post secondary art school:

- The objective of the art school is to develop the identity of a student into a professional artist as someone who can contribute new and original work to the field.
- Artistic development and professionalization entails developing a concept of art through learning material processes, developing creative problem-solving methods, and learning theory to situate oneself within the relevant discourse of contemporary art.

The curriculum is realized in a studio context that facilitates material learning and social interactions.

- Art school pedagogy adopts a constructionist teaching philosophy that is student centred and values student individuality.
- Learning consists of open-ended, projects that are material and object based. Learning is scaffolded through discussions and demonstrations.
- Theoretical learning develops the discourse of the art world to support and legitimize material practices.
- Evaluation is open-ended and depends on the opinions of the group members taking part in the discussion-based critiques.

- The curriculum structure and assessment practices appear ambiguous because of the open-ended nature of project-based learning and because teaching values individual progress.

Deskilling and the Art School

Although the tools and materials of production play a critical role in shaping artistic development and creative thought, reflecting both what and how artists think (Carter, 2004), the role of skill in art school pedagogy remains ambiguous. While learning in the studio is often material and object-based, discussions of techniques and craft knowledge are frequently vague or displaced by arguments for deskilling. A persistent practice theory divide in the visual arts continues to separate art as material production from art as a subject of theoretical inquiry, reinforcing a long-standing dichotomy between thinking and making (Chorpening, 2014; Penny, 2019).

Both Singerman (1999) and Newall (2019) begin their critiques by asking why their experiences in art school failed to equip them with the technical skills necessary for becoming practicing or professional artists. For Singerman, deskilling accompanied the transformation of the visual arts into an academic discipline. As art aligned itself with the institutional logic of research and discourse, theory and language replaced craft as central pillars of the curriculum (Singerman, 1999, 2012). In contrast, Newall views deskilling as a consequence of the pluralism inherent in contemporary art, where no single technique, medium, or method can claim universal relevance. As a result, technical skill is no longer regarded as central to learning or evaluating artistic practice.

Elkins (2001) adds another layer of critique by exposing the poorly defined aims and methods of art school teaching. He questions whether art pedagogy does anything beyond imparting a limited set of technical abilities, despite the rhetoric of conceptual sophistication. While Orr and Shreeve (2018) offer a more detailed account of art school pedagogy, they too acknowledge that skill remains difficult to articulate, occupying a space between verbal and non-verbal forms of knowing. The legacy of the atelier model still haunts comparisons with contemporary pedagogies, even though such training methods have largely disappeared from modern institutions.

This de-emphasis of skill reflects deeper historical and philosophical assumptions about knowledge. From Plato's mistrust of perception to Descartes's 'mind-body dualism, and more

recently, the rise of linguistic and symbolic models in cognitive science and continental philosophy, western epistemology has long privileged propositional knowledge ("know-that") over procedural knowledge ("know-how"). This bias continues to shape how we define and assess learning in the arts (McGuirk, 2012; Johnson, 2017; Penny, 2019). Even as the mind-body split is increasingly challenged, its legacy persists in the belief that artistic knowledge is tacit, un-codifiable, and difficult to teach.

These contradictions are evident within contemporary theories of art pedagogy. On the one hand, Orr and Shreeve (2018) argue that learning occurs through material engagement in the studio, yet they concede that this knowledge remains largely tacit. Newall (2019) advocates for the masterclass model, which seems to emphasize skill acquisition, but also asserts that no specific skill is required to become an artist. Meanwhile, both Elkins and Newall argue that while creativity is the ultimate goal of art education, it is not something that can be directly taught. In contrast, Sawyer (2018) offers a more integrated view, suggesting a strong relationship between studio engagement, skill development, and creative outcomes. His research reinforces the idea that creativity emerges through extended material processes, where skill and making are not peripheral but central to artistic thinking and learning.

Summary: What is Artistic Thinking?

The aim of this literature review is to situate the present research within the broader field of art education and to examine how this field conceptualizes artistic thinking. At the outset, this review posed the question of whether artistic thinking constitutes a distinct form of cognition, or whether it reflects foundational aspects of cognitive psychology. What emerges through the literature is that artistic thinking is closely tied to the methods of knowledge acquisition that are used and valued across different domains of art education.

In K–12 contexts, the emphasis lies in how the arts contribute to general education and child development, whereas in art school the focus shifts toward professional development, with attention to pedagogical methods and curricular structures. Despite these differences in scope and objective, learning about art and learning how to make art are central principles that extend across all levels of education. A set of common threads can be identified regarding the attributes of artistic thinking:

- It is grounded in artmaking processes that involve material engagement and skill.
- It cultivates perceptual acuity.

- It relies on the use of imagination.
- It engages with open-ended problem-solving and interpretive judgment, especially within the context of critiques.
- It includes the capacity to critically reflect on outcomes.
- It involves connecting artistic practice to cultural theory and context.

These cognitive and creative abilities are typically directed toward producing artworks that communicate ideas situated within the artist's personal, social, and cultural contexts.

However, this review also identifies contradictions and significant omissions. With the growing interest in cognition, the visual arts have had to confront enduring challenges; particularly the roles of sensation, embodiment, and affect, which were historically excluded from dominant models of cognition. These tensions are acknowledged in the writings of Efland (2002) and Eisner (2002) but are largely absent in the Studio Thinking framework (Hetland et al, 2015). The Studio Habits of Mind (Hetland et al, 2015), while useful, are presented as distinct components, echoing the structure of Gardner's (2006) multiple intelligences. This atomized presentation reflects a broader commitment to classical cognitive science, which often conceptualizes thinking as computational and modular, distinct from sensory, motor, or affective systems (Barsalou, 2020).

In contrast, understanding artistic thinking through the lens of embodied cognition provides a way to address some of these theoretical contradictions. In their critique of Studio Thinking, Berenhaus and Cupchik (2020) argue that research should focus first on understanding the knowledge of teachers, before examining how and what they teach, highlighting the need to ground pedagogy in lived, embodied expertise. The core objective of this doctoral research is therefore to explore the embodied nature of artistic thinking: how it unfolds through material processes, how it can be conceptualized, and how that knowledge might inform pedagogical content that can be meaningfully transferred into teaching contexts.

Chapter 3. Tacit Knowledge in Painting

Following the literature review on artistic thinking across educational contexts, this section turns to a foundational piece of practice-based research that informed the development of this doctoral project. My MA thesis, *Tacit Knowledge in Painting: From Studio to Classroom* (Marinkovic, 2011), addressed a pedagogical dilemma I encountered as a teaching artist: how to articulate the non-verbal and practice-based knowledge embedded in the painting process and transfer it into meaningful studio teaching. Using practice-led (Sullivan, 2010; Candy & Edmonds, 2018) and action research methodologies (Kemmis et al, 2014), the study examined how Michael Polanyi's (1966) theory of tacit knowledge, particularly the structure of focal and subsidiary awareness, could inform the cognitive processes of painting.

Tacit knowledge

Tacit knowledge refers to forms of knowledge that are enacted in skillful performance and can be difficult to explain. Characterised as non-verbal, non-conceptual, subjective, and experiential, tacit knowledge is contrasted with explicit, conceptual, theoretical, or codified knowledge (Gourlay 2006; Nonaka & von Krogh 2009; Tsoukas 2011). Whereas Ryle (1945) described this as the dichotomy between 'know-how' and 'know-that', this is also known as the practice-theory divide. Polanyi believed that the distinction between objective and subjective knowledge is an artificial construct because knowledge is a human process that implies actions and individuals. (Polanyi 1958, 1969).

Polanyi used Gestalt psychology to describe knowing as a relationship of parts to a whole. The ability to draw or paint is a complex skill made up of focal and subsidiary knowledge. Focal knowledge is a complex skill as a whole, whereas the various abilities needed to execute it are the subsidiary knowledge parts. In tacit knowledge thinking moves from the subsidiaries to the focal aim (Polanyi 1958). The from-to movement of tacit knowing is founded on the notion of background and foreground awareness (Searle, 2004). Subsidiary knowledge is often so deeply integrated into a complex skill that an individual is either not aware of it or does not actively think about it (Polanyi 1958, 1969). As a hallmark of expertise, Dreyfus (2002) referred to tacit knowledge as transparent coping; the ability to resolve problem-solving situations with such fluidity that we are unaware of the complexity of our thinking and actions.

Research summary

Conducted in the context of a twelve-week landscape painting course for adults at a non-profit art school, the research was supported by studio-based paintings, audio-recorded teaching sessions, questionnaires, and reflective journaling. I documented the material process from start to finish for 5 different painting subjects that were part of the curriculum.

These processes were analyzed to understand the subsidiary knowledge, or the background thinking that was needed to achieve the painting objectives. The information that emerged from the analyses was the content knowledge that was then transferred to teaching. The analyses and photo documentation were developed into video tutorials that were made available for student reference. Whereas the studio painting process enabled me to articulate content knowledge, the studio classroom informed the development of pedagogical content, thereby establishing a dialogue between creative practice and teaching.

Through the analysis of both studio and classroom data, three interrelated modes of cognition emerged: Visual Thinking, Material Thinking, and Qualitative Thinking. (Figure 3.1) These were synthesized into an artistic thinking model (ATM) that represents the dynamic interplay between body, mind, and materials in the act of painting. Each mode of thinking reflects how thinking is enacted during the artistic process and can be used respond to the pedagogical needs of learners as they develop material practices.

- **Visual Thinking:** develops visual problem-solving through the skills of observation, visual analysis, compositional judgment, and perceptual refinement.
- **Material Thinking:** develops abilities to engage with materials through material knowledge, technical application and embodied gestures.
- **Qualitative Thinking** accounts for how individual experience guides interpretations, emotional discernment, and aesthetic judgment.

Whereas visual and material thinking represent the embodied actions of the process, qualitative thinking mediates the choices and decisions that are made.



Figure 3.1 Artistic Thinking Model

These modes of thinking are not distinct stages but mutually entangled processes operating in tandem throughout the artistic process. For example, when choosing colours for a painting, visual thinking is used to analyze a subject and simplify the complex colour structure. Knowledge of colour theory is applied to the materials to organize the palette. Material thinking is used to determine the methods and techniques of painting. Qualitative thinking refers to an awareness of the expressive intentions of the chosen colours and techniques. By distributing thinking across the brain, body and environment, the ATM offers a reconceptualization of studio-based pedagogy as intertwined acts of cognition.

The ability to break down the knowledge and skills of the process were valuable exercises for me as an educator, because many of them were so deeply ingrained in the process that I was not always aware of them. This method of analysis facilitated the conceptualization of knowledge that is not readily available for studio teaching. The modes of thinking in the ATM represent categories of skill development that can be used to structure teaching content, and by extension assessment. The Artistic Thinking Model that resulted from this research became a tool for designing lessons, guiding demonstrations, and scaffolding student learning in ways that respected the complexity of embodied artistic knowledge. It also challenged assumptions about how knowledge is formed, expressed, and transferred in art education.

This doctoral research builds upon this foundation by positioning the Artistic Thinking Model within current theories of 4E cognition: embodied, embedded, enacted, and extended. These perspectives offer a theoretical basis for understanding artistic thinking as a form of ecological cognition, deeply situated in the physical and social contexts of making and teaching. The next section introduces this theoretical framework and explores its implications for reconceptualizing cognition in art education.

Chapter 4. Theoretical Framework

What is Cognition?

Cognition refers to the processes by which we perceive, attend, remember, learn, and solve problems. It is a multidisciplinary field that integrates philosophical theories of mind with empirical research in psychology, neuroscience, linguistics, and artificial intelligence. The emergence of cognitive science in the 1950s marked a paradigm shift in psychology, heavily influenced by developments in computational theory and information processing models (Varela et al., 1991/2016; Johnson, 2017). This foundational period is often referred to as classical cognition, traditional cognition, or first-generation cognitive science.

The Shift Toward Embodied Cognition.

By the late 20th century, several researchers began to critique the underlying assumptions of classical cognitive science, giving rise to the field of embodied cognition (EC). Shapiro (2019) outlines how embodied cognition challenges three foundational tenets of classical cognition:

1. The constitution argument: Cognition occurs solely in the brain, separate from bodily processes.
2. The representation problem: Cognition depends on abstract, amodal representations.
3. The grounding problem: Conceptual thinking is disembodied and language-like.

The following sections contrast classical and embodied models of cognition, with attention to how these differing views conceptualize the mechanics of thinking, the role of mental representations, and the nature of perception and action.

The Mechanics of Thinking.

Classical cognition adopts a computational theory of mind, where the brain is analogized to a computer: the hardware is the brain itself, and cognition is defined as symbolic information processing. Thinking is conceptualized as an internal, modular process that occurs in discrete areas of the brain under the control of a central processing system (Fincher-Kiefer, 2019; Friedenberg et al., 2020). In this model, the body plays a causal but peripheral role. Sensory

inputs are fed into the system, where they are processed and then produce motor outputs, establishing a linear, feedforward model of perception and action. This model treats the body's perceptual and motor systems as separate from the thinking process itself (Friedenberg et al., 2020; Shapiro, 2019). Hurley (1998) famously referred to this as the 'cognitive sandwich': a model where perception and action are like slices of bread, separated by cognitive processing.

Mental Representations and Concept Formation

At the heart of classical cognition is the computational-representational theory of mind, which posits that cognition involves manipulating internal symbols that represent external reality. Sensory input is transformed into mental representations, which are then processed to guide thought and behaviour (Anderson, 2014).

These representations are understood as amodal or arbitrary symbols, lacking direct correspondence to the sensory-motor systems of the body. In this view, the mind operates much like language: just as the word apple does not resemble the fruit itself, mental representations are abstract stand-ins for objects, events, or concepts (Lakoff & Johnson, 1980; Lakoff, 2018). Thus, perception, action, and cognition are treated as discrete processes, with thinking occurring primarily through the manipulation of these internal, language-like representations.

Conceptualisation.

Concepts function as organizing systems that enable us to make sense of experience, engage in reasoning, and structure our understanding of the world. Broadly, concepts are categorized as either concrete or abstract. Concrete concepts derive from direct embodied experience, interactions with physical objects, places, people, or things. In contrast, abstract concepts represent intangible phenomena, such as freedom, love, or faith, which do not have direct physical referents (Shapiro, 2019; Borghi et al., 2017; Barsalou, 2008; Kövecses, 2015).

In classical cognitive science, conceptual knowledge is assumed to be amodal, that is, it resides in a representational system that is separate from perceptual, emotional, motor, or episodic modalities of the brain (Barsalou, 2008). For example, the sensory experience of seeing, touching, or tasting an apple is abstracted and encoded into amodal symbols that stand for the concept apple. These symbols are then used in cognitive processes, independent of the sensorimotor systems from which they originated.

This symbolic system draws heavily on traditions from analytic philosophy and linguistics, where meaning (semantics) is established through the relationships between symbols in a structured, rule-governed system (Taylor & Littlemore, 2014; Kövecses, 2015; Lakoff, 2018; Johnson & Tucker, 2022). According to this view, the concept apple would be understood through its semantic links to other concepts, such as fruit, red, sweet, crunchy, tree, or pie, regardless of any direct physical experience. However, a major critique of this symbolic view lies in its self-referential nature: if concepts derive meaning only through relations to other concepts, how is meaning grounded in the world? This is known as the symbol grounding problem. It challenges how abstract or even basic perceptual concepts (such as color or democracy) can acquire meaning without being connected to embodied, situated experience (Barsalou, 2008; Borghi et al., 2017; Lakoff, 2018; Shapiro, 2019).

Embodied Cognition

Embodied cognition has been actively developed over the past thirty years in response to the foundational assumptions of classical cognitive science. Rather than constituting a single unified theory, embodied cognition encompasses a family of related frameworks that include enactive, embedded, extended, and embodied approaches—collectively known as 4E cognition. Though these perspectives differ in emphasis, they share a central premise: cognition is not confined to the brain but arises from the dynamic interaction of mind, body, and environment (Newen et al., 2018).

Embodied Cognition and Conceptual Metaphor Theory

Up until the late 1970s, dominant theories in linguistics, especially those developed by Noam Chomsky, held that syntax and grammar were rooted in formal, logical structures. This view paralleled the computational theory of mind, which framed thinking as an amodal, symbolic process, analogous to language (Taylor & Littlemore, 2014; Lakoff, 2018). However, this approach gave rise to what became known as the symbol grounding problem: how do abstract concepts such as color, democracy, or freedom acquire meaning if mental symbols lack any connection to bodily or environmental experience? (Johnson, 2017; Lakoff, 2018; Kövecses, 2015).

In response, Lakoff and Johnson (1980) introduced Conceptual Metaphor Theory (CMT), a central contribution to the field of cognitive linguistics. CMT posits that abstract concepts are not arbitrary or disembodied but emerge from mind–body interactions with the physical and social world. Metaphors are not merely poetic or rhetorical devices; they form the basis of our

conceptual system. According to this theory, we understand and experience one kind of thing in terms of another, a process known as cross-domain mapping. Conceptual metaphors allow embodied experiences to be projected onto abstract domains, shaping both language and thought. For instance, image schemas and motor schemas developed in early childhood (such as up/down, front/back, container, balance, or movement) structure how we later understand more complex ideas.

Primary metaphors are built from recurring bodily experiences. Spatial orientations like up and down become linked to affective states, giving rise to metaphors such as 'happy is up' and 'sad is down'. These metaphors are evident in everyday expressions like 'I'm feeling up today'; 'my spirits are rising'; or 'that news brought me down' (Lakoff & Johnson, 1980; Johnson, 2017; Lakoff, 2018; Johnson & Tucker, 2021). One foundational schema, the source-path-goal metaphor, structures how we understand movement and progress: we regularly experience ourselves or objects moving from one location to another. In the phrase "your comments lifted my spirits," this metaphor links upward motion (source-path) with a positive emotional outcome (goal), demonstrating how emotional experience and physical orientation are conceptually integrated (Lakoff, 2018; Johnson & Tucker, 2021). Conceptual metaphors thus function through one-directional ontological correspondences, where an embodied source domain is mapped onto an abstract target domain. This mapping is not arbitrary or purely linguistic but is grounded in bodily experience and lived interaction with the world (Lakoff, 2012, 2018; Johnson, 2017; Johnson & Tucker, 2021).

Enactive Cognition

Enactive cognition presents a fundamental challenge to classical cognitive science by rethinking the aims and mechanisms of thinking. Rather than viewing cognition as the execution of internal symbolic operations, enactivism defines cognition as the sense-making activity of a living organism dynamically coupled with its environment (Varela et al., 1991/2016; Thompson & Stapleton, 2009; Anderson, 2014). Cognition is not confined to the brain but emerges from the interactions between brain, body, and world; a process shaped by sensorimotor capabilities, environmental affordances, and cultural contexts.

The enactive perspective is grounded in phenomenology and ecological psychology, particularly the work of Merleau-Ponty and J. J. Gibson. Merleau-Ponty emphasized the primacy of lived experience and the body's central role in perception and action. Enactivists build on this by asserting that cognition always arises within a background of embodied human experience,

and cannot be divorced from the physical, social, and cultural conditions in which it occurs (Varela et al., 1991/2016; Gallagher, 2023).

Drawing from Gibson's (2015/1979) theory of affordances, enactive cognition recognizes that organisms perceive the world in terms of opportunities for action. However, whereas Gibson considered affordances to be objectively available in the environment, enactivists argue that affordances are relational, they emerge from the organism's sensorimotor repertoire and intentions (Chemero, 2008; Thompson & Stapleton, 2009). What the environment affords depends on what an organism is able to do and perceive.

A key distinction between classical and enactive cognition lies in how each understands the relationship between perception and action. Classical models frame perception as an input and action as an output—linked linearly through internal representations. Enactive cognition, by contrast, sees perception and action as reciprocally constituted in an ongoing, circular process (Varela et al., 1991/2016; Gallagher, 2017). This principle is captured in the concept of sensorimotor contingencies: the learned regularities between movement and perceptual change (O'Regan & Noë, 2001). Through embodied engagement with the world, individuals learn to anticipate outcomes and act skillfully.

Enactivism also reconfigures our understanding of mental representations. While classical cognition posits abstract, amodal symbols manipulated by discrete brain modules, enactive and embodied theories argue that concepts are multimodal and formed through embodied simulations (Barsalou, 1999, 2013, 2020; Anderson, 2014; Gallagher, 2023). This position is further developed in simulation theory, where Barsalou suggests that when we think about a concept, we partially re-enact the perceptual, motor, and emotional states associated with previous experiences of it. For example, Barsalou (2020) describes a “pizza simulator”: when we think of pizza, we mentally activate sensory experiences, its smell, taste, visual appearance, texture, and emotional connotations. These multimodal experiences are aggregated over time into a flexible, evolving concept. Rather than being fixed abstractions, concepts are simulations shaped by repeated bodily encounters.

Importantly, enactive cognition is not reducible to overt bodily movement. A common misconception is that embodied cognition requires visible motor activity. In reality, action refers to purposeful, goal-directed engagement with the world, which may be covert or internalized

(Barsalou, 2020; Engel et al., 2015). Through such dynamic interactions, the organism builds cognitive structures that enable it to understand, anticipate, and act meaningfully.

In the context of art education, enactive cognition offers more than a framework for understanding physical skill acquisition. It provides a theoretical basis for examining how concepts emerge from and are shaped by material engagement, perceptual learning, and affective interaction with artistic processes. Thinking and knowing in the arts, from this view, are enacted through and inseparable from embodied doing.

Extended Cognition

Extended cognition is both a theory of mind and a paradigm of cognition, introduced by Clark and Chalmers (1998) in their seminal article “The Extended Mind”. It challenges the notion that thinking and reasoning are processes confined to the brain or body. Instead, it proposes that cognitive processes can extend into the environment, meaning that external elements in the physical and social world play a constitutive role in cognition, not merely a supportive one. The central tenets of extended cognition include:

- Active externalism
- Constitutional coupling
- Continuous reciprocal causation
- The parity principle.

Active externalism posits that, in certain contexts, elements external to the body play an active role in cognitive processing. These are not simply aids or tools but are functionally integrated into how we think (Clark & Chalmers, 1998). Constitutional coupling refers to the reciprocal interaction between an individual and external elements such that the two form a coupled cognitive system. In this system, each component contributes causally to cognitive performance. If the external element is removed, cognitive competence is diminished (Menary, 2010; Gallagher, 2023). Continuous reciprocal causation implies that cognition arises through ongoing mutual coordination between and agent and the environment. Information flows both ways: the external element influences the agent’s thinking, and vice versa. This dynamic becomes crucial in processes requiring incremental, externalized steps, such as solving equations, drafting architectural plans, or sketching visual ideas (Clark, 2008; Heersmink, 2015).

The parity principle is the most controversial aspect of extended cognition. Clark and Chalmers (1998) argue that if an external process functions identically to an internal one, it should be considered equally cognitive. This principal claims that certain external elements don't just scaffold cognition, they are constitutive in it. For parity to hold, the external element must be readily available, reliably accessible, and integrated into the cognitive process. (Chalmers, 2019)

To illustrate this, consider an artist engaged in figure drawing with a live model. The act of drawing is an incremental, recursive process involving constant interplay between observation, mark-making, and sensory-motor feedback. The drawing progresses through a series of decisions, each informed by what is already on the paper, what is observed in the model, and the tactile response of hand to paper. In this system, the artist, the model, the charcoal, and the paper form a coupled network of cognition. If the model were to leave, the artist might continue, but the real-time visual reference and embodied interaction would be lost, altering the cognitive landscape of the task. In this sense, the model's presence is not peripheral; it is constitutively linked to the thinking process. This coupling aligns with the Gestalt notion of part-whole relationships: cognition arises through coordinated interaction between internal and external elements. The whole is greater than the sum of its parts, and cognition is not located in the head alone but distributed across the body, the tools, and the environment.

Recent developments in predictive processing have further linked extended cognition with dynamic models of perception and action. According to this framework, the brain continuously generates predictions about the world and updates them based on sensory feedback (Clark, 2016). This process relies on constant interaction with the environment, suggesting that external structures can become integral to minimizing prediction error. From this perspective, sketching, note-taking, or material manipulation are not just outputs of thought but part of an ongoing cycle of perception, prediction, and action, further reinforcing the view that cognition is distributed across the brain, body, and world.

Material Engagement Theory

While much of the literature on embodied cognition focuses on how thinking functions across diverse human activities, Material Engagement Theory (MET) centers on how cognition emerges through the creation and use of material artifacts. Developed within the field of cognitive archaeology, MET explores long-term human cognitive development through the study of objects and their role in thinking. Although its origins are not explicitly concerned with artistic

production, MET offers valuable insights for understanding artistic processes and embodied cognition in material practice. Malafouris (2013) outlines three key theoretical components of MET: the extended mind, the enactive sign, and material agency

The Extended Mind.

MET uses principles from embodied and extended cognition to describe how the process of making brings individuals and materials into a reciprocal relationship. Thinking does not precede making; rather, thinking unfolds through material interaction. As Schön and Bamberger (1983) suggest, this ‘conversation with materials’ allows materials to co-direct the course of action. Malafouris (2013) calls this a ‘cognitive assembly’, a dynamic system in which the maker and the material are reciprocally coupled, each contributing to the unfolding of thought.

The Enactive Sign.

The enactive sign refers to how meaning is constructed through iterative, embodied engagement with materials. It draws on Peirce’s semiotics, which differs fundamentally from the Saussurean model aligned with classical cognition. In Saussure’s linguistic model, signs (words or sounds) are arbitrary and derive meaning through cultural convention. This aligns with the amodal symbolic systems of classical cognitive science (Johnson, 2017). In contrast, Peirce’s triadic model allows for greater flexibility in meaning-making by incorporating experience, iteration, and embodiment. Signs may be:

- Icons, which resemble their referents (e.g., a photograph).
- Indices, which are causally linked to what they signify (e.g., smoke as an index of fire).
- Symbols, which signify through cultural convention (e.g., white as a symbol for purity). (Chandler, 2017).

Malafouris argues that material signs cannot be reduced to linguistic symbols. The qualities of materials, such as the reflective surface of polished metal, are not arbitrarily assigned; their meaning is experienced through perception and action. Thus, the meaning of a material must be engaged physically, not just interpreted symbolically. Material signs have some correspondence with language, but they are not equivalents.

Material Agency

MET rethinks agency and intentionality by integrating the material dimension of thought. Agency is typically associated with the initiation of action, while intentionality refers to the directedness of thought. Following Searle (2004, 2016), intentional acts require a “direction of fit” with conditions in the world. For instance, the intention to paint a landscape assumes both the availability of materials and certain background abilities, such as the capacity to mix paint or identify compositional elements. Searle’s background knowledge is analogous to Polanyi’s subsidiary knowledge, the integrated, often tacit abilities that enable action. In this view, intentionality is distributed, and co-shaped by internal aims and the affordances of materials.

Material agency, then, disrupts dualisms between form and meaning, or between thinking and doing. From an embodied perspective, materials co-determine the course of thought. Malafouris (2019) illustrates this using the example of drawing: classical cognition frames drawing as the execution of a pre-formed mental image, translated into marks via motor commands. MET, by contrast, sees drawing as an action–perception cycle, a feedback loop in which thought emerges through the act of mark-making. The pencil or charcoal is not meaningful in isolation; it becomes meaningful through epistemic action, a transformation of matter that brings about a transformation in significance. In this process, metaphoric mapping occurs meaning is projected from a concrete sensory-motor domain to an abstract conceptual one, underscoring the material grounding of cognition.

Embodied Cognition research in art education.

The shift from classical to embodied cognition represents a fundamental reorientation in how artistic thinking and learning are understood. Classical models often depict cognition as abstract, symbolic, and disembodied, locating creativity in internal mental representations and planning. However, the embodied cognition perspective reframes artistic skill as an adaptive, process-driven engagement with body, environment, and materials. Current trends in research are increasingly moving towards an embodied cognition framework across different areas of learning. (Macrine & Fugate, 2022). In the fine arts and design, Montarou (2014) and Baber (2018) reject the notion of drawing or making as the execution of internal mental plans, instead framing it as a dynamic negotiation between the body, materials, and perception. These authors emphasize the role of bodily schemata and material exploration in artistic thinking. Diethelm (2019) reframes design as a process of thinking through doing, where cognition arises from the interaction of body, mind, materials, and environment, a position that aligns strongly with Embodied Cognition and Material Engagement Theory. Rather than treating drawing or

prototyping as representations of internal thought, he presents them as cognitive acts themselves, emphasizing learning as a transformative, situated practice. By illustrating how a young student learns how to carve a flute, Gulliksen (2017) highlights the cognitive growth enabled by sensorimotor making and demonstrates how concept formation arises through the act of making, not prior to it. Vaisvaser (2021) shows how embodied, relational brain processes underlie creative transformation. Across these studies, skill emerges not as static technique, but as dynamic, embodied intelligence developed through doing, sensing, and interacting. These are but a few examples that offer a robust challenge to disembodied cognitive theories, positioning artistic learning as a fundamentally embodied and interactive process.

Building on this embodied perspective, my research draws specifically on embodied cognition and MET to investigate how artistic thinking emerges through dynamic interaction of the artist with tools, materials, and the sensory environment. Rather than treating creativity as a process internal to the mind, this framework emphasizes cognition as enacted, extended, and materially situated. This orientation informs both the design of my study, and the interpretive strategies used to analyze the lived experience of artistic making. Table 4.1 offers a summary of the central concepts of embodied cognition and material engagement theory. The following chapter outlines the methodological approach employed to explore these embodied processes in practice.

Table 4.1 Summary of Theoretical concepts for Embodied Cognition

Type of cognition	Principal Characteristics
Embodied	Cognition arises from embodied human experience and cannot be divorced from the body.
Embedded	Cognition is situated in the physical, social, and cultural conditions of an individual.
Enactive	• Cognition is a goal-directed engagement to make sense of experiences in the world. • A cognizer is dynamically coupled with the environment. • Cognition relies on the relational affordances between an individual and the environment. • Cognition arises from the reciprocal relationship of action and perception
Extended	• External elements are constitutionally coupled with an individual establishing a reciprocal relationship. • External elements are reliably available for thinking to happen. • Integrated with predictive processing, where the mind generates predictions for action and perception, and revises mental models based on embodied experiences.
Material Engagement Theory	
Extended Mind	• Thinking is distributed across mind, body, and environment. • Thinking is constitutionally coupled with materials.
Enactive Sign	Meaning is actively constructed through embodied interaction with materials.
Material Agency	Materials play an active role in shaping thought and action. Intentionality and agency are distributed across brain-body-materials.

Chapter 5. Research Methods

Research Questions

This doctoral research addresses a gap within our understanding of artistic thinking and material processes of artmaking. It is an exploration of thinking through the actions of artmaking to evaluate the Artistic thinking model (ATM), and to develop methods for studying how thinking is embodied in artmaking processes. The research questions that guided the study are:

1. What is the relationship between thinking and action in the artistic processes of the artist-teachers?
 - How is this made apparent through their artmaking demonstrations and the interviews?
2. How can the Artistic Thinking Model serve as a method for analyzing the material process of artmaking?
 - Can the modes of thinking be observed and documented in the material processes of the participants?
 - How can these modes of thinking be understood through the theories of embodied cognition and material engagement theory?
 - Can the model be used to guide the conceptualization of the material process into pedagogical content for teaching?

The research is structured using empirical qualitative research methods that are examined using a multiple-case study framework. The case studies implement the methods of practice-based research and cognitive task analysis.

Research Methods

Case study research

Case study research is characterized by an in-depth description and analysis of a phenomenon that exists within a clearly delineated system. (Stake, 2006; Merriam & Tisdell, 2016). In this research, the phenomenon that is studied is how the Artistic thinking model can be applied to the material process of artmaking to understand the embodied nature of thinking. The participants who took part in this study are artist/teachers who have dual professional practice as visual artists and as educators. For the purposes of the research, the concept of professional artistic practice means that the participants create and publicly exhibit their artwork,

and professional teaching practice means that they teach art at a post-secondary level within colleges, universities, or in community arts programs. An active dual profession as an artist/teacher is a suitable boundary condition for exploring the research question (Yin, 2014; Creswell & Poth, 2018).

Given the individual nature of artistic practice and how both knowledge and teaching are linked to an artist's specific practice, each participant's contribution is treated as an individual case study. Whereas a case study can examine more than one case to understand a specific phenomenon, such as cognition, I have chosen to use a multiple case study method because each case is a distinct artistic method with unique features of analysis (Stake, 2006). According to Yin, (2018) multiple-case studies can potentially yield more robust outcomes than an individual case study because the design follows an analogous logic that implements replication, which is similar to multiple research studies. The ability to compare the various cases is also a means of achieving triangulation. Throughout the research, the different cases were compared, enabling me to synthesize the results across cases and develop a broader view of the research topic (Stake, 2006; Yin, 2014; Merriam & Tisdell, 2016).

Practice-based research

Practice-based research, also called practice-led research, is research that uses artistic practices and processes to discover new knowledge for a field of study (Niedderer, 2022). It is research that focuses on artistic practice to learn something about the nature of practice, the tools, the materials, and the context of creation. Data collection focuses on the documentation of the artistic process, and as the researcher, I was directly involved in the process as a facilitator. (Borgdorff, 2012; Candy & Edmonds, 2018; Bell, 2019). Bell (2019) proposes a method for studying creative processes that is derived from design research methods and Schon's (1983) concept of reflective practice. Artistic practice is seen as a cycle of concrete material actions that are observed and analyzed to arrive at a conceptual understanding that are further tested through more concrete material actions. Cyclic iterations have been instrumental for developing insights and the opportunity to further refine the conceptualization of practice.

Cognitive Task Analysis (CTA) refers to research and data analysis methods that aim to describe the cognitive processes that are involved in skilled performance (Tofel-Grehl & Feldon, 2013). CTA represents a branch of expertise studies used in developing skills training, educational design and learning theories, and answers questions pertaining to cognition, perception and knowledge application (Hoffman & Militello, 2008). As a research method, CTA

employs different empirical data collection methods with research participants. The data collection methods that are utilized include semi-structured interviews, participant observation of skilled performance, knowledge audits, questionnaires, and cognitive mapping (Hoffman & Militello, 2008; Shadbolt & Smart, 2015; Gore, et al., 2018).

Whereas practice-led research yields data and information regarding the actions used in the artmaking process, cognitive task analysis contributes to understanding the thinking structure that is part of the actions of artmaking. Cognitive maps articulate the structure of the thinking processes.

My Role as Researcher

I have been teaching visual arts classes in different contexts for 20 years, and I have been a practicing artist for thirty years. As a researcher, I am deeply familiar with the professional culture of both the artist and the teacher, and my perspective is that of an insider (Creswell & Poth, 2018) which means that I can relate to the participants' experiences, and I am able to understand their knowledge application and teaching experiences. Sharing the cultural practices of the participants has facilitated my access to them and my ability to understand the intricacies of their practices. A characteristic element of research in cognitive task analysis is the close collaboration that exists between the researcher and the participants (Hoffman & Militello, 2008). Throughout the data collection, I observed and facilitated the creative actions of the participants for the purposes of the research.

Research Design and Data Collection:

Participant Contribution and Ethics

The period for the data collection was approximately 1 year. Following the approval of the Concordia University ethics review panel (Annex 1), I prepared a written invitation to take part in the research and sent emails out to the community art centers where I teach, and I also sent emails to artist/teachers within my professional milieu. Following ethical protocols, after explaining the research protocols, each participant signed an ethical participation form. An example of this form is found in Annex 2. The form clearly stated that the participant had the freedom to withdraw from the project at any moment in time without any negative consequences. I explained that confidentiality could not be assured because the research would highlight their visual artwork and use images of their creative processes. The participants were

aware of this before agreeing to take part in the study and they gave me permission to use their names.

Data collection

The forms of data that were collected and analyzed include individual participant interviews and participant observation of artistic processes. The data was in the form of digital audio recordings and digital film recordings. The research design and forms of data collection have been aimed at constructing an in-depth awareness of each participant's creative material practice. The research had three phases that included:

1. Initial interview.
2. Artmaking, demonstration.
3. Follow-up interview.

Each phase of the research explored the various aspects of the participant's knowledge regarding artmaking and their manner of conceptualizing that knowledge for teaching. This information became apparent through the interviews and the documentation of the artmaking demonstrations. Table 5.1 shows the time that I spent with each participant for the various phases of data collection. Member checks and data verification were undertaken with 4 of the five participants.

Table 5.1: Time spent with participants for data collection				
Participant	First interview	Pre-demonstration interview	Artmaking demonstration Video	Post-demonstration interview
Claudine	3 ½ hours	30 minutes	1 ½ hours	1 hour 40 minutes
Michael	5 hours	15 minutes	1 ½ hours (plus 3 hours that were not used)	1 hour
José	2 hours	1 hour	40 minutes	1 hour
Genevieve	4 hours	10 minutes	1 ½ hours	30 minutes
Mary	3 hours	30 minutes	Approximately 1 ½ hours	25 minutes
Total hours	15 hours	3 ½ hours	7 hours	4 hours

The initial interview explored the knowledge and values of the participant regarding artistic practice and teaching. The artmaking demonstration explored and documented the actions used in artmaking and how the artist was able to verbalize and conceptualize their process. The final phase of the research is a member check to validate the findings. The interview questionnaires are in Annex 3. The following will describe the research phases in greater detail.

Phase 1: Introductory Interview:

Each participant took part in an initial semi-structured interview to explore their educational background, teaching experience, and artistic practice. This included the opportunity to view the participant's artwork. Three of the five participant interviews took place over a digital platform such as Zoom. Two interviews took place in the artist's studio. The interviews lasted approximately 2 - 3 hours. The participants were made aware of the general topics of the interview but did not know the precise questions.

The aim of the interview was to construct a detailed description of the artist/teacher's learning history, artmaking, and teaching practices. This enabled me to construct a general understanding of the participants' experiences and beliefs in these three areas and how they are related to each other. Understanding the participant's educational background offered insights into formal and informal learning experiences and to a certain extent, it demonstrated how formal education influences how they describe and conceptualize their artistic practice. While looking at the participant's artwork, I asked them questions regarding their artistic practice to understand their material approaches and artmaking methods, and how they conceptualized and situated their practice within the broader practices of artmaking.

Discussions about their artistic practice included the subjects and themes that are prevalent in the artwork as well as the expressive intentions of the work. This line of questioning relates to qualitative thinking. Questions about materials that the artist commonly uses, material methods and techniques provided information regarding the processes used in making art and relates to material thinking. The way that the artist depicts their subjects will offer information regarding visual thinking. For example, understanding if the artist works from observation, from preliminary sketches, from imagination or memory will help understand their visual thinking processes.

Questions regarding teaching experience offered insights into pedagogical methods and values. The participants were also asked to directly compare their creative practice with their

teaching practice. This line of questioning enabled me to understand how the artist transferred their practice-based knowledge to their teaching practice. It also offered another means of understanding how the artist conceptualizes creative practice. The responses to the interview questions provided clues about the participant's awareness of how their educational experience affects their teaching methods and values, and to what extent their artistic practice informs their teaching practice.

The initial interviews that took place on Zoom were recorded by the Zoom application and then saved on my computer. The in-person interviews were recorded with audio recording software on an iPad. These initial interviews, as well as subsequent interviews, were transcribed using online transcription software.

Phase 2: Artmaking Demonstration

The second phase of the research was an artmaking demonstration that lasted between 1 1/2 to 2 hours. This research activity included an initial interview during which the artist was asked to describe the artmaking project. The artmaking demonstration was filmed using a tripod and iPad video software. After the demonstration, there was a follow-up interview to discuss aspects of the demonstration.

At an agreed upon time, the participant performed an artmaking demonstration in a space that the participant normally used or was comfortable using. Taking into consideration that each artist works at different rates and rhythms in their practice, this research activity did not require the documentation of the artistic processes from initiation to the end because for many artists this would have taken a considerable amount of time. In two cases, I was able to document the creation of artwork from start to finish. In one case, I documented the first stage of the creation of a painting, whereas in another case I documented the later stages of a painting. In most of the case studies, I did not interact with the artist during the artmaking process. Although three of the five artists were comfortable discussing their actions during their demonstration, two of the artists preferred not to talk while working. One of the artists asked me to leave the room while she was creating because she felt my presence would inhibit her. In that case, I started the video recording software and then returned at the end of the session.

The aim of this research activity is to document the participants' actions during the artmaking process, to examine how thinking is embodied and enacted. The pre-demonstration and post-demonstration interviews ask the artists to describe their intentions, their thinking

processes and explore if, and how they conceptualize their actions in a coherent manner that could be transferable to teaching. My questions focused on how the problems of the artmaking process are verbally articulated, the methods and skills needed to resolve the stated problems, and the expressive intent of the process.

Data Analysis

Initial Interview

The introductory interview went through several cycles of coding. The first cycle bracketed the conversation into categories that related to the concepts covered in the questions: educational background, artistic practice, teaching practice. (Saldana, 2016) Categorizing the interviews enabled me to refer to what the artists said when analyzing the videos of the artmaking demonstrations. After the analysis of the artmaking demonstrations, the initial interview was further analyzed to understand how each artist conceptualized their artmaking practice and their material processes.

Artmaking Demonstration

The artmaking demonstration had three phases that included a pre-demonstration interview, the artmaking demonstration, and a post-demonstration interview. The interviews were coded to understand the goals of the artist, their ability to describe the thinking used in the process, and the significance of the artwork they had created.

Coding of the pre-demonstration and post demonstration interview:

The interviews were coded to determine how the artist described the artmaking process, the goal of the process, the methods and techniques that were used and the expressive intentions of the process. The outcomes of this analysis guided the development of the cognitive maps that were created from the cycles of analysis of the videos.

Post-demonstration coding and analysis:

The post demonstration interviews sought to understand how the artist articulated aspects of the process, the goals and challenges that were confronted and, if possible, the meaning of the work. These interviews were coded first with memos summarizing the responses to the questions. I then looked for clues regarding visual, material and qualitative thinking processes to determine if and how their responses indicated something about the connection between thinking and action during the material process, and how that contributed to meaning construction. Excerpts of the responses are used throughout the sections on the

research findings, and they were particularly useful when developing the section on qualitative thinking (see Chapter 10). The responses also contributed to the data analysis of the videos. The analysis of the post-demonstration interview was compared to the initial interview and the pre-demonstration interview to determine if the description of the artistic practice aligned with the description of the demonstration.

Analysis of the artmaking demonstration:

Various methods of cognitive task analysis were used to analyze the videos of each participant's artmaking demonstration. The first level of analysis was process mapping which studied the evolution of the artmaking process (Shadbolt & Smart, 2015; Gore Banks, & McDowall, 2018). Cognitive task analysis examined the artmaking process to discover and understand problem solving strategies, patterns of action, the focus of attention, and decision-making (Gray et al, 2014). Concept mapping focuses on the conceptual knowledge needed to achieve the various goals of the artmaking process. (Shadbolt & Smart, 2015; Gore Banks, & McDowall, 2018). Each video went through multiple cycles of analysis which is further discussed below.

First Cycle: Synopsis of the artmaking process

The aim of the first cycle of video analysis can map the stages of the artistic process. The aim was to understand the evolution of the artmaking process, and to create a synopsis. This was repeated for each of the five artmaking demonstrations. I viewed each video multiple times and using video editing software, individual frames were extracted and saved. This process yielded between 150 to 200 photo frames. The photo frames were then uploaded to PowerPoint software and saved as a video slideshow. The resulting video slideshow lasted between 3-5 minutes. This enabled me to review the artmaking demonstration more efficiently. The extracted photo frames were used as the main data set for the rest of the data analysis.

First cycle of coding:

The first level of coding is descriptive. I wrote a general description of the artmaking process focusing on the goals of the process and how they evolved, the materials that were used, the methods, tools and techniques that were applied to achieve the goal of the process. At this stage, I extracted individual photo frames that represented the stages of evolution of the process.

Second cycle of analysis: Mapping focal and subsidiary Knowledge

The artmaking process was broken down into specific stages of evolution. The initial set of photo frames were analyzed, and the set was reduced to approximately 50 images. This second data set of photo frames was analyzed and coded by describing the actions that the artist was taking and how those actions represented transformational steps in the process. These steps represented the intermediate goals of the process. This method, described as bracketing or framing (Glyfe et al, 2016) facilitates the ability to more readily recognize meaningful actions that would otherwise be difficult to pinpoint within the continuous flow of the artmaking process. A change in focus, attention, a different action, or a pause in the flow of action helped determine where to bracket the process. Each bracketed segment was first analyzed using the concepts of tacit knowledge to map out focal and subsidiary knowledge (Shadbolt & Smart, 2015). Focal knowledge represents the goal of the process, whereas subsidiary knowledge represents the knowledge that is needed to achieve and execute a specific objective. The steps of the process were described, and then the types of knowledge and skills needed to achieve them were outlined.

Third cycle of analysis cognitive mapping using the ATM

The evolution of the artwork and the intermediate goals of the process were analyzed through the three modes of thinking of the ATM. The objective was to determine if the modes of thinking were visible in the actions taken at each stage of the artmaking demonstration and how they contributed to the evolution of the artwork. The following questions were used to guide the analysis of each stage of evolution:

Visual Thinking:

Understanding the nature of visual thinking examined the visual construction of the artwork and the embodied actions of the artist. The following questions guided this analysis:

- What was the visual focus of the artist within the step of the process?
- How was the visual focus related to the subject matter?
- How did this relate to the material actions?
- What actions were taken to illustrate visual thinking?
- What are the visible changes to the artwork?

Material Thinking:

Material thinking was analyzed by examining how the artist engaged with the materials and how this contributed to the transformation of the artwork. Some of the questions that guided the analysis for material thinking:

- What was the nature of the material actions?
- What types of methods, tools and techniques were used?
- Was there an overall method that could be discerned?

The relationship between VT and MT:

- What relationship is observed between visual and material thinking through the actions of the artist?
- What is the goal of this interaction?
- Is there a visual or material concept that can be used to describe this?

Qualitative thinking

- What types of choices were made relative to the subject matter?
- How did these choices reflect personal judgements and interpretations of the subject?
- Was there a visible pattern in the interpretation of the subject?

These phases of analysis were organized into a chart for each participant. An example of the chart is in Annex 4. Each section of the chart represents the stage of the evolution of the artwork. The goal of the specific stage represents the focal knowledge of the stage. The subsidiary knowledge describes some of the central skills needed to achieve the goal. The columns of the chart describe the visual, material and if possible, the qualitative nature of thinking.

Throughout the data analysis, I closely examined how the interviews with the artists, alongside the visible actions and intentions within the artmaking demonstrations, could be interpreted through various theories of embodied cognition. This proved to be a significant challenge, as no established methodology currently exists to guide such an approach. The research outcomes presented in the following chapters illustrate how I gradually developed an understanding of the embodied dimensions of the artists' thinking processes. These chapters

integrate both data analysis and interpretation, grounded in the theoretical framework outlined earlier. The next section introduces the participating artists.

Research Participants

This section introduces the five participants involved in the research. Each is a professional visual artist with an active artistic practice and extensive teaching experience in visual art. As practicing artists, they exhibit their work regularly and have been teaching studio art to adults in various settings, including non-profit art centres, colleges, and universities. All participants have over ten years of teaching experience (some up to forty), and each has maintained a mature artistic practice for over twenty years, building a substantial body of work. The following descriptions provide an overview of each participant's educational background, artistic practice, and teaching experience.

Claudine Ascher

Claudine Ascher holds degrees in theatre performance and education. After several years of teaching in secondary schools, she pursued further studies in the visual arts, obtaining a second undergraduate degree in sculpture and a master's in art education. Claudine taught visual art at community art centres for thirty years, during which she also served as a program director. Alongside her teaching and art practice, she worked as a gallery curator for over two decades, developing exhibition spaces for both professional and emerging artists. Her curatorial work often involved themed exhibitions that brought artists together to collaboratively create and present work.



Claudine preparing the clay for the sculpture



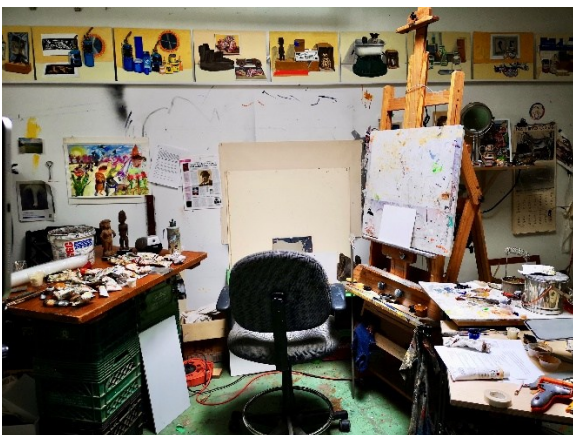
Finished portrait study

Figure 5.1 Claudine's Demonstration

Claudine's artistic practice focuses on figurative sculpture and drawing. She maintains a kiln in her studio and works primarily in fired and glazed clay. Her background in theatre and dance has sharpened her sensitivity to bodily movement and gesture, which are central themes in her work. Her figurative pieces are narrative-driven, inspired by personal experiences, human interaction, and her love of storytelling. For this research, Claudine created a small portrait sculpture in clay. The demonstration, filmed in her studio, lasted approximately two hours. It was an exploratory study, intended not as a finished work but as the potential starting point for a future series of clay portraits. Figure 5.1 are photos from Claudine's artmaking demonstration.

Michael Merrill

Michael Merrill studied at the Museum School in Montreal during the 1970s. Early in his career, he worked in animation studios in Toronto before transitioning to full-time practice as a visual artist. His work has been exhibited at the Montreal Museum of Fine Arts and the Musée d'art contemporain de Montréal, and he is represented by a Montreal-based gallery. Michael has taught visual art at universities in Ontario and at the Visual Arts Centre in Montreal for over twenty years. Michael is a realist painter working in oil, acrylic, ink, and watercolour. Much of his work is created in situ, emphasizing the artist's experiential perspective. While observation is a cornerstone of realistic and figurative painting, it is the defining element of Michael's practice. He has received Canada Council grants supporting creative inquiries in locations such as Paris, the Lascaux caves in France, and the southern U.S. to explore and paint the different sites of land art from the 1970's.



Michael's Studio setup



Finished painting in oil

Figure 5.2 Michael's Demonstration

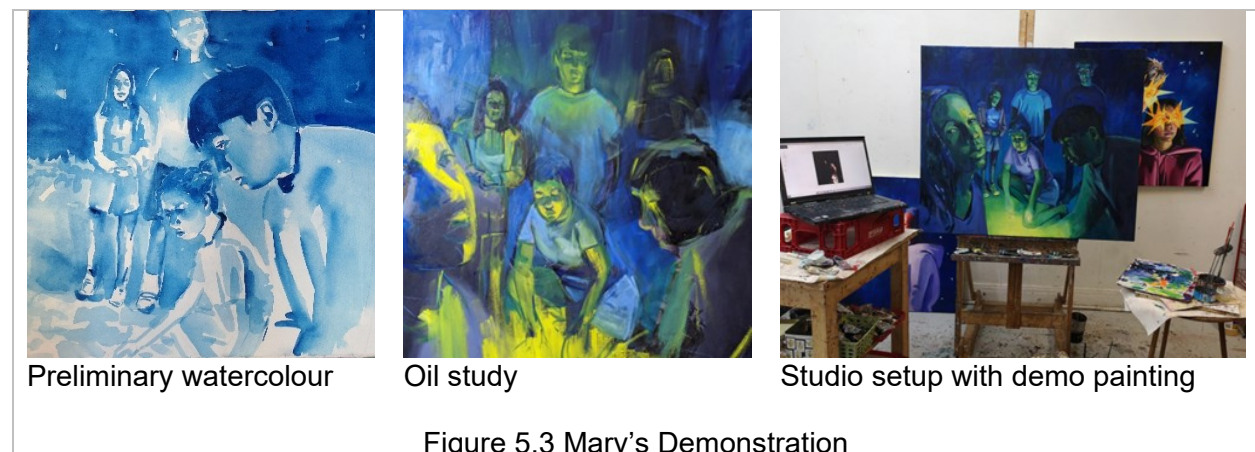
For this research, Michael painted a still life in oil, which was documented over a two-hour session. The subject was a worn paint tube placed before a reflective metallic surface—one of many still life compositions he created during the pandemic. These works later inspired a larger body of paintings, culminating in a solo show at Galerie Roger Bellemare in 2023. Figure 5.2 illustrates Michael’s studio setup: easel and palette on the right, paint tubes on the left, and prior still life paintings on the wall above and in front of the chair (the still life setup that was part of the demonstration is obscured from view). The finished demonstration painting is on the right.

Mary Hayes

Mary Hayes holds a BFA from Concordia University and has taught visual art for nearly twenty years in community and college settings. Her practice blends oil and watercolour, merging observation and imagination. Her figurative work often features family members and draws from personal experience as well as popular culture.

“What I do is I meet with my extended family—nephews, nieces, daughter—and I give them prompts for different poses. I take lots of pictures. The best ones are where nothing much is going on, but there’s some kind of intensity in the pose that sparks an idea.” (Mary, pre-demonstration interview)

Her work is organized into thematic series exploring adolescence, life events, and cultural motifs. She regularly exhibits in cultural centres in Montreal.



For this research, I documented the final stages of a painting from her Destroyers series, which explores mysterious adolescent narratives inspired by pop culture. The two-hour studio

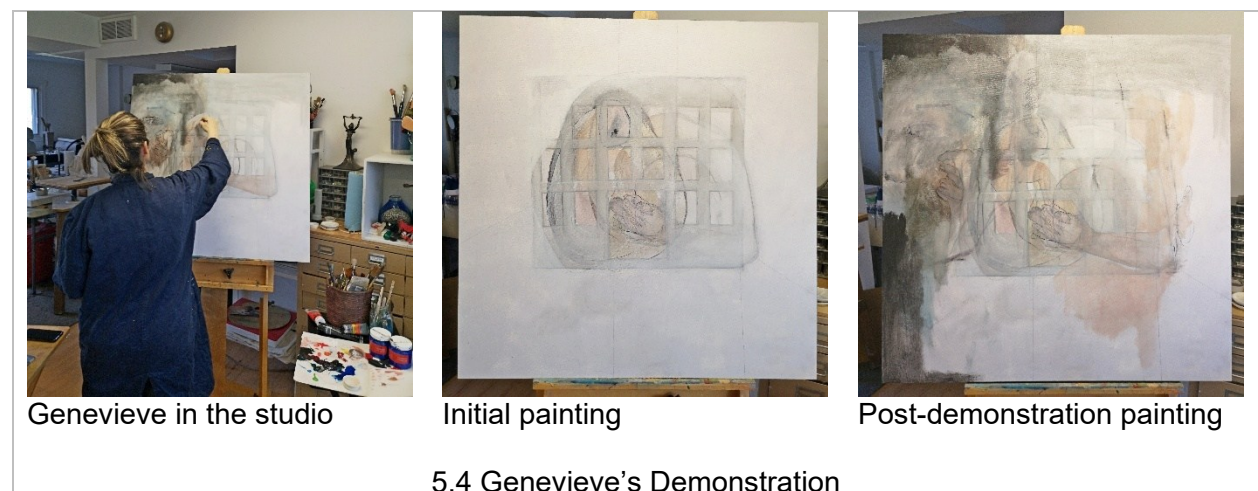
visit included video documentation and a walk-through of Mary's early process, including her studies and photo references. Figure 5.3 shows photos of her preliminary studies and the studio setup with the demonstration painting on the easel and another painting from the series.

Geneviève Sidaleau

Geneviève Sidaleau completed her BFA and MFA at Concordia University. She has over ten years of teaching experience in adult education and community art settings, including courses at McGill University. Her artistic practice includes painting, drawing, and installation, with regular participation in residencies and solo/group exhibitions. Geneviève explores themes of existential suffering and survival through figurative abstraction. Her work is emotionally charged, often catalyzed by global events. In her words:

"People have called my work empathy art, and I relate to that. I read the news and couldn't get over some stories—these images would stay with me. I think about the suffering body, the body in need, and how people endure or perish in difficult journeys." (Geneviève, initial interview)

For this research, Geneviève painted on a large canvas using acrylic. Due to renovations at her home studio, the demonstration took place at Claudine Ascher's studio. Uncomfortable with being observed while painting, she requested to work alone; I filmed the process and checked equipment intermittently. We conducted short interviews before and after. Her painting began on a previously started canvas, continuing her practice of letting meaning emerge spontaneously. Although the subject matter was not predetermined, it aligned with her ongoing themes of personal struggle. Figure 5.4 illustrates her at work and the stages of the painting.



José Cortes

José Cortes is a Mexican artist and educator who, at the time of this research, was a doctoral candidate in Art Education at Concordia University. He holds a BFA and MFA in fine arts and previously taught at the Universidad del Arte in Puebla, Mexico. José's practice is conceptual and installation-based, using found and fabricated objects to explore intersections of time, memory, and identity. Unlike the other participants, his practice is not rooted in a specific medium, rather he learns and adapts with the materials as needed. One example is *Light Years*, a grid installation of 250 matchbooks, each inscribed with the date of a fire in the city where the matchbook originated.

For his demonstration, José created a series of portraits based on missing persons. Participants from his graduate studio course provided their birthdate and gender, which he used to search public databases. From found images, he created contour drawings and then digital portraits, which were printed on canvas.

"I had a solo show and used a missing person's profile—someone my age and similar in appearance—in the exhibition promo. It raised questions about identity, visibility, and the affirmation of presence in artistic practice." (José, pre-demonstration interview)

The finished series of works is shown in figure 5.5

The profiles presented above offer insight into the diverse experiences and practices, and of the five artist participants. Their unique contributions provide the foundation for the analysis that follows. In the next six chapters, the research outcomes are explored in depth, drawing upon the recorded demonstrations, interviews, and contextual materials. Each chapter builds on the case studies introduced here, highlighting key themes, patterns of artistic thinking, and the embodied processes at play in their creative work.



Figure 5.5 José's finished series of portraits

Chapter 6. Research Findings: An artmaking system

Introduction

The ATM was originally developed to understand and articulate the tacit connection between thinking and action in my painting process, with the goal of transferring this knowledge to teaching. The research and the artwork that I created was in the context of a painting class that focused on developing material skills and visual interpretations related to specific topics. I selected artmaking subjects with clear visual references that were easy to observe and study. These subjects served as objective starting points for analyzing the material process. This approach not only helped create effective demonstrations for students, it also made the painting process easier to analyze.

In this study, the participants selected the subject matter for their artmaking demonstrations based on their individual interests and artistic practices. In some instances, the formal visual subject was clearly identifiable through the use of visual references; in others, it was more ambiguous, or no visible reference material was used. As a result, the analysis of the artmaking process could not consistently adhere to the original ATM method, which relied on establishing a relationship between a visual reference and the structure of the artwork. Given the variety of subject matter used by the participants, it was clear that before beginning to analyse their thinking processes, it was necessary to consider the intentional content of thinking, or what they were thinking about (Searle, 2006, 2015). This initial section of the research outcomes explores the resources that the participants used in their artmaking demonstrations, to understand if there are any common features or patterns that can be identified across the different practices. This will be followed by a brief theoretical discussion of systems theory that lays the groundwork for an interpretation of the artmaking process as a dynamic and emergent system.

The resources of the artmaking demonstrations

When I arrived at the artist's studio for the artmaking demonstration, each artist was in a space that was organized for the work that was about to take place. Although every studio is somewhat different, each artist has a dedicated space to house tools and materials, working tables and easels, and lighting to facilitate their work. The workspace is systematically organised to support the workflow. Tools and materials are readily available and placed easily

within reach. For example, each of the three painters has a table next to their easel that has tubes of paint, a palette, a rinse tub for brushes, and rags or paper towels. When they are not using brushes, they are either in a jar or on the table. All these things are within arm's reach. Visual references, when they are present, are on the other side of the easel. Michael positions the still life to the left of him, whereas Mary has a computer loaded with photo references that she scrolls through as needed.

Below is a brief description of each participants' artmaking subject. It is organised according to the presence and use of visible reference information.

- Michael painted a still life from direct observation. The still life was visible and placed next to his easel.
- José created a hand-drawn portrait from observation. He used a photo reference that he observed on his computer.
- Mary was working on a figurative painting that was based on a blend of observation and imagination. She used reference photos stored on her computer to inform the poses and portrait features of the figures.
- Genevieve created an abstract painting based on imagination and the use of reference photos in a magazine.
- Claudine created a portrait in clay from imagination. There were no visual references used.

Each participant's artmaking demonstration began with a brief interview that asked the artist what they were making and if they could describe the subject of their artwork. The interviews lasted between 15 to 30 minutes. Although the subject matter for each artmaking demonstration varied, there is a common pattern in how the artists described the work they were creating. They each established a connection between their artmaking subject and their previous work, as well as with their personal interests and experiences.

The participants related the artmaking subject to their ongoing artistic practice, and their previous work. Four of the five artists were creating works that were part of an ongoing series.

Claudine:

“today I am doing a face, a sketch that will either be a finished piece or a sketch. I am working with the clay I usually use” (Claudine, pre-demonstration interview).

Claudine’s demonstration is an exploration of a portrait that may potentially lead towards a series of portraits of artists that she knows, where the style of each portrait will be based on the artist’s creative practice. Claudine’s work focuses on the human figure as a means of expression. The style of her clay sculptures combines realism with imaginary elements, that she describes as magical realism.

Michael:

“So it’s basically just finding things in the studio, that are just here and just putting them together...But it’s been interesting. What I’ve been finding interesting is what do I put there? And as I think more about it, it actually gets harder and harder to do, because I’m thinking more and more about it.” (Michael, pre-demonstration interview)

Michael’s still life demonstration forms part of a broader series of paintings that explore objects within his studio environment. Throughout his career, he has used serial exploration of subject matter as a method for investigating the relationship between direct observation and visual interpretation.

Mary:

“And it’s paintings of younger people, teenagers, kids. And I pose them in situations that are kind of evocative of pop culture, teen thriller.”(Mary, pre-demonstration interview)

Mary’s demonstration is a narrative figure painting that is part of a series called the Destroyers. Her subjects revolve around pop culture to create work that blends observation and imagination. In this painting she is depicting adolescents discovering a glowing object in an ambiguous night landscape setting.

José:

“I have this list of all my classmates and their age, and I look for profiles of people missing in Montreal, or Quebec, or Canada...what I’m working on is to make these 12 portraits of missing people related to my other classmates by gender and age, to

pass them through this filter, to have these artificial paintings and print them out as small canvases” (José, pre-demonstration interview)

José’s demonstration is part of a series of portraits based upon missing people in Canada. This series connects to previous work that examines the concepts of presence and absence of individuals in time and space. It explores the notion of how objects like artworks can represent someone who is not physically present.

Geneviève:

“I was just thinking of a face, maybe just being pushed. But it could absolutely go in a different direction. It kind of depends whether it’s working or not.” (Geneviève, pre-demonstration interview)

Genevieve’s demonstration integrates with her ongoing interest in exploring intense emotional states through the experiences of individuals who have suffered. Her work is a blend of observation and imagination that results in abstract figurative work that she describes as empathy paintings.

The participants established a connection between their artmaking subject and their personal interests or experiences.

- **Claudine:** Her potential series was connected to other artists that she knows and has worked with in the past. Claudine has worked as an artist/teacher and as a gallery curator, which has put her in contact with many other artists.
- **Mary:** The figures in her series of paintings are members of her immediate and extended family. She is interested in the risk-taking and thrill-seeking behaviour of adolescents and how it relates to the popular culture in film and television.
- **José:** The portraits of missing people are connected to classmates in a graduate studio class he is participating in. José has explored the concept of missing people and portraiture in previous work that he had exhibited in 2011 and 2013.
- **Genevieve:** Genevieve tied her choice of subject matter to the strong feelings elicited after viewing a documentary about the tragic suicide of a media figure.
- **Michael** had previously been working on landscape paintings and his interest in still life paintings reflected the condition of being sequestered inside due to the Covid pandemic.

He also linked the subject matter to demonstrations that he was creating in the exceptional circumstances of the Covid pandemic and teaching online.

When comparing the different demonstrations, what surfaced were the concepts of continuity and connection. Each of the artists described what they were making as part of their ongoing creative practices. They used materials and tools that were integral to their practices of artmaking. They used established methods that they had developed through their years of practice. Although what I witnessed in this research was one artmaking demonstration, the participants themselves made strong connections with their creative practices, the materials that they were working with, and their past personal experiences.

Realizing that the initial ATM did not account for subject matter led me to explore the concept of resources in artmaking. I began to explore the connection between the resources that are used in the artmaking process and the initial structure of the ATM. The answer was found within the theories of embodied cognition and dynamic systems. The next section gives a theoretical overview of dynamic systems theory and then connects it to the artmaking process.

Dynamic systems and embodied cognition

Embodied cognition adopts dynamic systems theory to understand the situated and embedded nature of cognition. The fundamental premise of embodied cognition is that cognition depends on an individual's experiences which are embedded within a certain physical, cultural and biological context. (Varela et al., 1991/2016; Gallagher, 2023) "On this view, mind is never separate from body, for it is always a series of bodily activities immersed in the ongoing flow of organism- environment interactions that constitutes experience" (Johnson, 2017, p. 72).

Rather than placing the focus on what happens inside the head, in the embodied perspective, cognition is a function of the coordinated interaction of the elements in the system (Gallagher, 2017, 2023; Colombetti, 2017). Dynamic systems theory is a tool that supports the study of the relationship between an agent and the environment because it can use parameters that are inside and outside the organism (Käufner & Chemero, 2015). Shapiro (2019) points out that adopting a dynamic systems perspective for cognition emphasizes that thinking unfolds through time AND adapts to the contexts in which it occurs. Whereas classical cognition (CC) views thinking as a linear activity, EC views it as a causal feedback loop, where there is no clear beginning or end. The causal loop reflects the dynamic interaction of the brain with the body and

the brain-body within the environment. Through the theory of embodied cognition, I began to explore the possibility of organizing the artmaking process as a dynamic system.

What is a dynamic system?

A system is a complex phenomenon comprised of various distinguishable elements that interact with each other to achieve a certain goal. Studying a system requires articulating the elements that make it function, the nature of their interaction, and the goal or outcome, which together constitute the boundaries of the system. To further understand the system, it is important to contextualise it by considering the environmental elements that surround it. These would be elements that can affect the system and give it a reason to exist. In systems thinking, boundaries are never definitive, but rather a means of studying a specific phenomenon, (Meadows, 2009; Dekkers, 2017). Since a real-life system and its environment can be rather large, the study becomes more manageable when the system and its environment are reduced to key elements (Dörner & Funke, 2017).

The key concepts that define a system are the elements, the structure and the environment. The elements are the fewest number of parts that are needed for the system to function. The relationships refer to the interdependence of the elements, and the environment refers to the broader context that the system functions within (Dekkers, 2017). The elements of a system have a conceptual boundary that separates it from the rest of the environment and allow them to be studied. The boundary of a dynamic system is operationally open, which means that elements that are external to the system can interact with it and effect it (Käuffer & Chemero, 2015; Dekkers, 2017).

An artmaking system.

Defining a system begins with determining the fewest elements or parts that are required for a system to function. As Dekkers (2017) point out, the elements “may range from physical objects to constructs of the mind, depending on the study’s objectives” (p.20). The elements within the defined system have a relationship with one another and can also have a relationship with elements that are outside of the boundary of the systems. As mentioned above, there were consistent and common resources that the artists brought to their work during the demonstrations such as an artmaking subject, materials and tools, their knowledge and experiences, and there is also the work as it evolves through the process. Following systems theory, I believe that the artmaking process can be construed as a system that is minimally

comprised of the following elements: an artist, an artmaking subject, materials, and an emerging artwork. The goal or outcome of the system is the generation of artwork.

The creation of artwork as a goal of the artmaking system does not exclude the realization of other objectives, such as a greater understanding of the self, the communication or expression of an idea, the desire to exhibit or sell work. Since the central aim of this research is to further develop and evaluate the ATM, the focus of the artmaking system is on the artmaking process rather than the function of the finished artwork as it may exist outside of the studio in contexts such as exhibitions. Nor does the research address the broader interpretation of art. The following section provides a more detailed description of the elements of an artmaking system.

The Artist:

When an artmaking process is undertaken, the artist brings a concept of artmaking which is embedded in their knowledge, experiential skills, and approaches to artmaking. According to Newall (2019), a concept of art includes the values and beliefs regarding the creation of art which are apparent in the material practice and processes of the artist. This includes the formal elements of an artwork, the style, medium, techniques used to create it and other properties of content. What Newall did not include in his concept of art is that the artist also brings their personal experiences, their knowledge and experience of their socio-cultural contexts, which includes knowledge of the artworld (art history, awareness of other artistic practices, galleries, etc.).

Each of the participants has twelve or more years of practice which includes an established portfolio of works and a record of exhibitions. Comparatively, each artist has a unique approach to artmaking. At the same time, each artist's concept of art can be situated within a larger cultural practice and history of artmaking, which establishes a connection between the artist and the external environment.

- Claudine: figurative sculpture with clay, working within the tradition of magical realism.
- Mary: Working with the human figure, she creates portraits and figurative narratives that are connected to popular culture. Her work is related to realism, narrative art and pop culture.

- Michael: works with oil, watercolour, ink and acrylic paint. He creates still life and landscape paintings that are based on direct observation and focuses on the visual perspective of the artist. Although his work can be situated in a formalist and modernist tradition of artmaking, the contemporary notions of lived experience are crucial to his philosophy of artmaking.
- Genevieve: works with drawing and acrylic paint. She creates expressive abstractions of the figure that represents her emotional connection to world events and personal experiences. Her work can be situated in a contemporary tradition of expressionism.
- José: works with diverse materials to create assemblages that explore the relationship between lived experiences, existential concepts and material culture. He creates and exhibits installations using a broad variety of materials, found objects and hand-made art.

The artmaking subject.

An artmaking subject is usually the point of departure for the artmaking process. It can begin with a visual reference, or it can be a topic of inquiry that will take on some visual form. The artmaking subject frames the questions, problems and goals of the artmaking process. It can be clearly articulated or vaguely described at the outset of the process. The artmaking subject will take on some type of formal visual structure that progressively emerges during the artmaking process. For many artists this happens through the transformation of materials. Transformation can also refer to a reconfiguration of objects as in the creation of installations.

There may or may not be a straightforward conceptual connection between the visual form of the artwork and the topic of inquiry, and this distinction is part of the form vs meaning dichotomy in art theory. The visual subject of the artwork can have a direct or indirect connection to a topic of inquiry. Depending on the artist's practice, objectives for making an artwork, the artmaking subject can be derived from visual references such as a photo or something that is directly observed from life; it could come from imagination, from memory or any combination of these. It is often related to some sort of direct or indirect experience on the part of the artist.

For example, in the case of Michael, the artmaking subject was based on the visible subject, which was a still life that included a paint tube and how it appeared on the reflective material that was fastened behind it. Claudine's visual subject was a portrait sculpture that was

derived from her imagination and the topic of inquiry was described as a potential idea for a series of works that linked portraits of artists to their concepts and styles of artmaking. Genevieve described the artmaking subject through her emotional response about current events that she witnessed through the media. The connection between her topic of inquiry and the visual subject matter was vague and emerged through the process.

The materials

The materials refer to the medium(s) of production such as paint, graphite, clay, paper, as well as other technologies such as digital cameras or digital artmaking software. It includes the support structures that materials may be applied to, and the various tools that accompany material manipulation. The artist physically interacts with the materials throughout the process and uses them to construct the emerging artwork.

The materials that an artist chooses to work with have a strong connection with the external environment. Materials can be a way to connect an artist to communities of practice, and a means of situating artistic production within the larger culture of art. Traditionally, artists settle into working with specific materials and processes such as painting, printmaking, sculpture, photography, etc. In contemporary art, however, the ability to engage in different areas of material practice is widely valued and taught within the academy (De Duve, 1994).

Three of the five participants (Mary, Michael, and Genevieve) identify themselves as painters and used paint as the medium for their artmaking demonstration. Claudine identifies her practice as ceramic sculpture and she used clay for her demonstration, but drawing is also an important part of her practice. José does not identify his practice with any single medium, and he does not consider himself as a specialist with a specific medium. For his demonstration, he combined drawing materials with computer software which ultimately resulted in a simulated painting that was presented as digital painting simulations that were on canvas.

Engaging with the materials is vital to both the creation of the artwork and the development of the artmaking subject. Schon (1983) described this as a dialogue with the materials. In material engagement theory, Malafouris (2013, 2018) views the interaction of the maker with the materials as an active and embodied coupling where thinking is enacted through the process and flow of making and engaging with materials.

The emerging artwork

The emerging artwork refers to the artwork as it evolves and is transformed through the artmaking process until it reaches its end state as an artwork. Throughout the process of artmaking, the artwork is continually changing, and as such the outcome is not absolutely specified. The emerging artwork refers to the progressive transformation of the artwork during the artmaking process. The emerging artwork arises through the ongoing interaction between the artist, the subject of inquiry and the materials, which leads to the formal visible structure of the artwork. It is where form and content come together to create something which communicates something meaningful.

This perspective aligns with material engagement theory (Malafouris, 2013, 2023) where the meaning of the artwork is something that gradually unfolds through the ongoing process of engagement with the materials. It allows for the unexpected outcomes that arise when the artist interacts with the materials to make sense of the artmaking process. Given that this research is focused on the artmaking process, I am distinguishing between the final artwork and the evolving artwork as something that transforms throughout the material process. Referring to it as emerging addresses the open-ended nature of the artmaking process and the unknown nature of its exact outcome at the end. The emerging artwork is strongly connected to each of the other elements in the artmaking system and coincidentally remains so even after the artmaking process is finished and becomes an artwork. However, the latter process, which occurs after the work is complete, speaks to how the work is interpreted rather than how it is constructed.

The artmaking system as a dynamic system.

Attributes of a dynamic system.

The interactive relationship between the elements is fundamental to understanding how a system is structured, how it functions, and why the elements belong in the system. A dynamic system has specific attributes that distinguish it from a static system. A dynamic system is non-linear, self-organising, and has emergent outcomes. The system evolves over time through feedback and through elements that are external to the system. Its connection to the external environment is hierarchical or nested, which means that a system exists within another system. This section examines the attributes of the artmaking system through the above-mentioned characteristics.

A dynamic system is nonlinear:

In a linear system, the output is directly proportional to the input, which means that changes to individual elements will reliably determine the outcome. The system is predictable (Meadows, 2009; Ladyman & Wiesner, 2020). For example, a cookie recipe precisely defines the quantity of each ingredient. If I double the ingredients, I will end up with twice as many cookies, or in my case, cookies that are twice as large. If I add more chocolate chips, the cookies will be more chocolatey. Each input change leads to a proportionate, predictable change in the output.

In a dynamic system, however, multiple elements interact in ways that are interdependent but not proportional or evenly distributed (Dekkers, 2017). The outcome cannot be prescribed in advance, and changes to one element cannot predict the overall result. Doubling a cookie recipe will likely yield more cookies, but the fundamental nature of a cookie remains intact. By contrast, adding more colours to a painter's palette will not necessarily result in a larger painting, and removing a colour won't be catastrophic. In artmaking, the elements do not interact in uniform or predictable ways. External conditions, lighting, mood, material behaviour, can alter outcomes at any stage. An artist can introduce a new element, like a tree or cloud in a landscape painting, midway through the process, potentially shifting the composition, tone, or emotional resonance of the entire work.

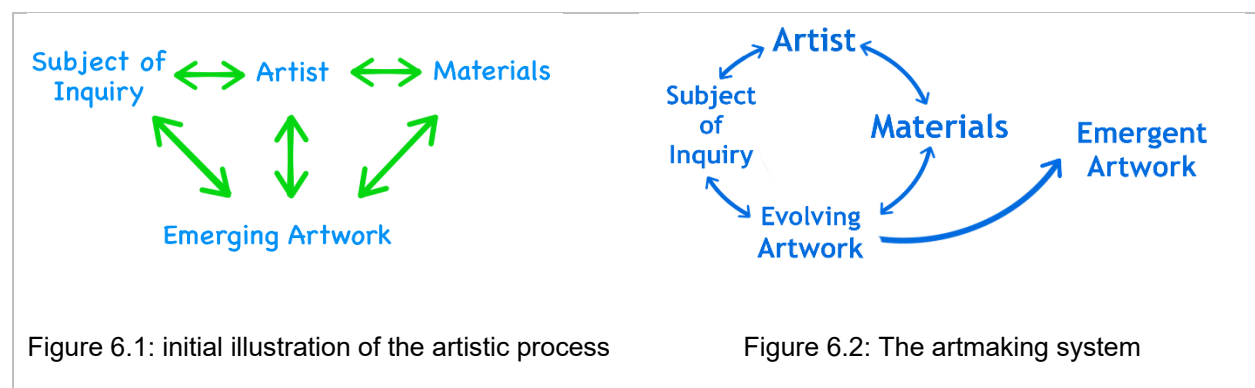
In a non-linear system, the behaviour of the whole cannot be explained by simply summing its parts. Changes to individual components do not linearly accumulate; rather, their interactions produce emergent outcomes that are often unpredictable (Richardson & Chemero, 2024). A linear model of the artmaking process might look like this:

$$\textit{Artist} + \textit{Subject} + \textit{Materials} = \textit{Artwork}$$

While this may serve as a simplified description of artistic production, particularly when reverse-engineering a finished work, it tells us little about how the process unfolds, nor about the shifting relationships between artist, materials, and subject. This view assumes stability and sequence and does not account for how thinking and decision-making evolve throughout the process. There are cases where a linear approach to artmaking appears to exist, for instance, when a student follows a book or instructional video to copy an existing work. Yet even in these instances, variation inevitably arises, whether through gesture, material difference, or interpretive nuance.

In scientific terms, linear systems are studied by breaking them into parts, because the behaviour of the whole can be inferred from the parts. Dynamic systems, by contrast, require us to study the relationships between parts relative to the whole, where ‘the whole’ refers to the evolving aim of the system (Johansson, 2004; Hutto & Myin, 2017). Components in a dynamic system are in flux, often softly assembled and temporarily configured as in the case of artmaking, where ideas, materials, and intentions shift throughout the process. What matters is not just what the components are, but how they behave in relation to each other and the surrounding context (Brinck, 2007; Richardson & Chemero, 2024).

Figure 6.1 illustrates an initial visualization of the interaction of the elements of the system. I found that this illustration did not depict the iterative nature of the process, nor did it show the eventual outcome of the process. In contrast, figure 6.2 illustrates interactions of the elements of the system and that they lead to the goal of the artwork.



Non-Linearity vs. Evolution

While the process of making an artwork clearly evolves over time, it is important to distinguish this evolution from the concept of non-linearity. Evolution refers to the gradual transformation of the work across time. It captures the development of the artwork or the artist’s relationship to the work as it progresses.

In contrast, non-linearity describes the structure of thinking and action as the artwork develops. The artmaking process often does not follow a predetermined sequence of steps. Instead, it is recursive, exploratory, and often unpredictable, marked by revisions, detours, and sudden insights. In painting, non-linearity might manifest in reworking earlier layers, shifting compositional decisions mid-process, or allowing material affordances to redirect the artist’s intention. Although both evolution and non-linearity involve change, non-linearity is

characterized by its irregular, back-and-forth logic, while evolution describes the broader arc of transformation over time.

Self-Organization

Self-organization refers to the capacity of a complex system to adapt to internal changes among its elements and respond to external influences over time. A system is considered dynamic because it changes, but it is considered complex when its elements are interdependent and responsive. In a self-organizing system, a change in one element initiates shifts across the entire system (Skyttner, 2005; Dekkers, 2017; Hutto & Myin, 2017).

As these elements interact, they exchange information and generate transformations. This feedback-driven process enables the system to evolve from an initial state of instability or disorganization toward a more ordered or coherent structure (Ladyman & Wiesner, 2020). Self-organization relies on continuous feedback loops: elements respond not just to external conditions but also to one another, resulting in emergent patterns or forms.

In the context of artmaking, the process often begins in a state of conceptual or compositional openness, a kind of productive ambiguity. The artist, the materials, and the artmaking subject exist in a loosely assembled configuration, without a fixed outcome. As the artist engages with the materials, choices begin to accumulate, forms emerge, gestures become structured, and a direction or coherence starts to develop. This is not imposed from the outside, but arises through the adaptive feedback loop between perception, action, and material response.

At each point in the process, the artist must respond to what the artwork is becoming. These pauses, moments of assessment, hesitation, or redirection, are not disruptions but integral components of self-organization. The artist might introduce a new material or compositional element, or just as importantly, remove or revise something that no longer fits. These decisions are not simply corrections; they are the system adapting to itself. Over time, what begins as an open set of possibilities begins to coalesce into structure. Meaning and form emerge not from a fixed blueprint, but through the recursive, situated dialogue between artist, materials, and evolving artwork.

Feedback loops

The interaction of the system elements generates information, and the system responds through ongoing feedback. Feedback loops determine how the system evolves, whether it stays the course or if changes are needed. Positive feedback reinforces the actions of the

system, pushing it forward, whereas negative feedback can slow things down and alter the way the elements interact. Feedback loops imply the iterative nature of the system's behaviour over time (Meadows, 2009; Deckers, 2017; Ladyman & Wiesner, 2020). In Figure Z, the arrows represent the iterative nature of the artmaking process as well as the interaction of the elements through feedback.

The ongoing assessments that the artist makes of artwork as it evolves determine the direction that the process will take. If the artwork is not communicating what the artist is thinking, or if the artist is responding negatively to the work, she may decide to pause and reflect, make subtle or radical changes to the work, and sometimes abandon it. On the other hand, if the artist is satisfied with the direction the work is going, she will forge ahead. I observed this with several of the artists during the research. In the case of Mary and Michael, the painting made during their demonstration was part of a series that led to a public exhibition. In the case of José, he did several iterations of the artmaking process that resulted in a series of portraits.

Emergent outcomes

A defining characteristic of a dynamic system is the nature of the outcome. When the outcome or goal of the system cannot be predicted or predetermined, it is emergent. Another way of describing this is through the concept of Gestalt psychology, where the whole (outcome) is greater than the sum of the parts. Although it is possible to distinguish the parts of the system, the outcome can only be understood through the interdependence of the parts (Skyttner, 2005). According to Reynolds (2020), “something new emerges that was unpredictable according to any analysis focused exclusively on the component parts, and the “whole” or the “structure” causally influences the parts” (p. 137).

This points to the notion that the whole may have properties that are meaningless in terms of the individual parts. Hence, studying the individual parts will not account for the outcome, which is why the interactions and relationships between the elements of the system are vital to understanding how it functions and what it gives rise to (Arnold & Wade, 2015; Dekkers, 2017). The emergent outcome reflects the non-linear and self-organizing nature of the dynamic system.

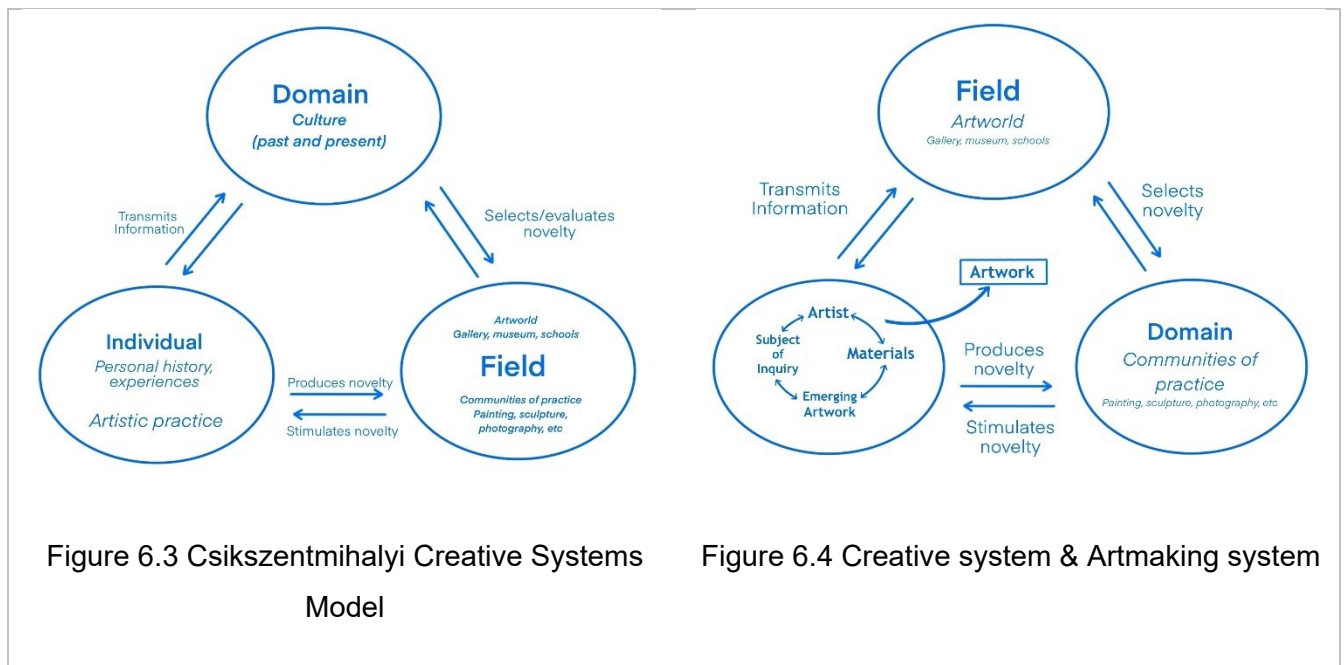
Nested Systems

A key aspect of a system is the context in which it functions. For example, for a practicing artist, a single artmaking process resulting in a work of art, is part of a larger artistic practice,

and the artistic practice of a single artist is nested within a larger system of artmaking processes or communities of practice. The nested nature of a dynamic system illustrates that there can be a system goal within another system's goal (Meadows, 2009). An individual artistic practice is nested within a socio-cultural context, within a specific period in time. The concept of a system within a system points to the hierarchical structure of systems (Ladyman & Weisner, 2020).

Creative Systems

In his research on creativity, Csikszentmihalyi (2014) adopted systems theory to illustrate that creativity arises from the interaction of three systems: the individual, the domain, and the field. The domain of the arts is embedded within culture. It represents past and present knowledge and surpasses that of any single person. Within the visual arts, the individual has a personal history and artistic practice. Figure 6.3 is an adaptation Csikszentmihalyi's (2014) model, illustrating the elements and directional arrows that indicate the circular causal relationship between the individual, the field and the domain.



The field affects the social structure of groups within the domain and recognizes the contributions of an individual or a group. (McIntyre, 2016) The field of visual arts is comprised of different groups of individuals such as museum curators, galleries, art schools, and communities of practice which include artistic peers. An artist will learn and develop domain knowledge from the contributors to the field. As an artist creates work and exhibits it, different members within

the field will evaluate the work to determine if it is a creative contribution to the field. The members of the field are gatekeepers who decide if the work should become part of the cultural domain. In the field, there are intermediaries who make up a network of experts that determine what work is accepted and disseminated (Sawyer, 2012). According to Sawyer (2012), the artist internalizes the domain and contributes to the field through the creation of novel work. The field will select what is novel and it will then become part of the domain.

Figure 6.4 embeds the artmaking system within Csikszentmihalyi's creative systems model, illustrating how an individual artist creating an artwork is embedded within a larger system. The inclusion of the creative systems model illustrates that the elements external to any individual artist's practice establish a relevant context for an artmaking system. These external elements also demonstrate the open nature of the artmaking system and how the environment can affect what artists may do in their practice.

For example, a gallery, as an external element, may decide that it wants an artist to make more drawings rather than paintings, because they are selling well. Looking at the art-making system, if the artist normally works with paint, and as a response to the gallery, the artist adopts charcoal or graphite as a material, the artist will also make certain adjustments to the art-making process. This also illustrates that in a dynamic system, the goal of the system can still be achieved even if a core element is changed. Hence, there is a complementarity between the function of a system and its structure.

Summary

This chapter began by addressing an unanticipated question that emerged during the research: What is the artist thinking *with* during the process of artmaking? The response to this question is found in the resources that the artists used during the artmaking demonstrations.

While each artist possesses a distinct approach to their creative practice, certain patterns and elements emerged across the case studies. These core elements include: the artist as an individual with specific domain knowledge and subjective experience; the artmaking subject, which frames the questions, problems, and goals of the process; the materials, which serve as the means of transforming the subject into visual-material form; and the emerging artwork itself, which evolves progressively toward a final outcome, constituting the goal of the system.

When examined through the perspectives of embodied cognition and dynamic systems theory, these core elements are conceptualized as an artmaking system. The artmaking system

will be used as the foundation for the ongoing analysis and development of the research outcomes. Responding to this question also brought to light missing elements in the initial structure of the ATM which is the intentional content of thinking. The next section will lay the groundwork for understanding how the elements of the system interact and how it can be integrated with the ATM.

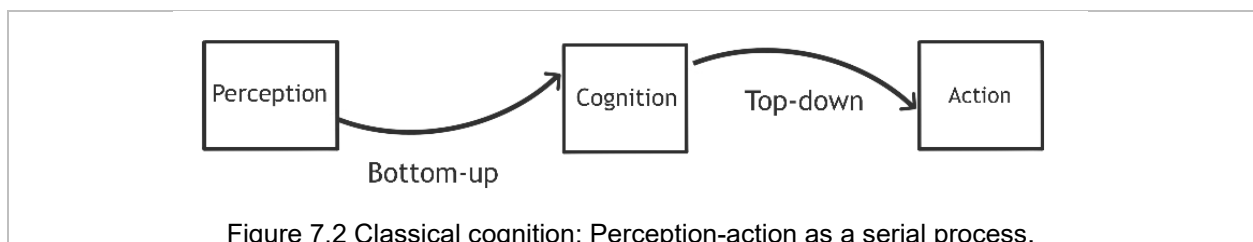
Chapter 7: Action-Perception in the Artmaking System

Introduction

The previous section identified the resources involved in the art-making process and conceptualized them as components of an art-making system. A key concern in the study of dynamic systems is understanding how these elements interact to produce outcomes (Dekkers, 2017). This section examines the general patterns of interaction within the art-making system, with a particular focus on the processes of action and perception. The relationship between perception and action is fundamental to theories of cognition. Notably, classical cognition (CC) and embodied cognition (EC) differ significantly in their conceptualizations of this relationship. This section begins with an overview of each theoretical framework, followed by a presentation of the research findings.

Action & perception in Classical cognition:

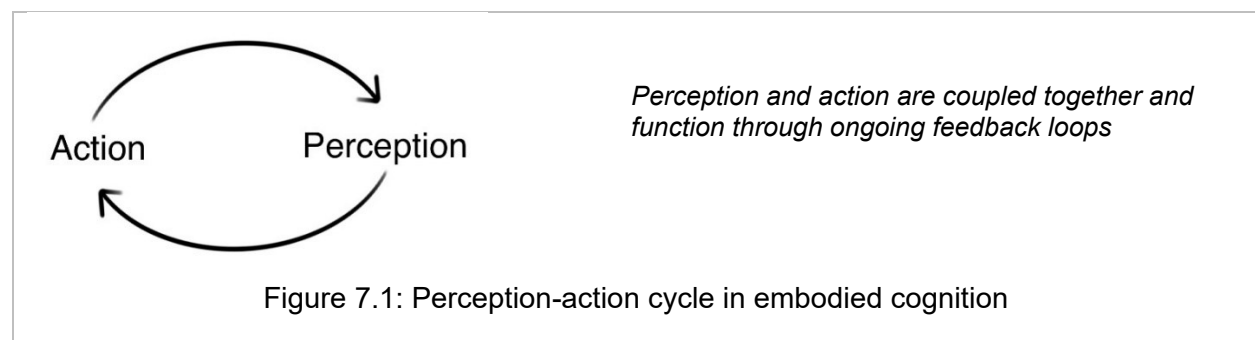
CC views thinking as an internal process that is distinct from perception and bodily actions. Perception is a passive bottom-up process that gathers information from the environment as raw input data (Figure 7.2). We observe the world; information is gathered and then encoded by the brain. The brain transforms perceptions into mental representations that are used for computational operations, reasoning, and formal rules-based thinking. As a top-down process, action is viewed as an output that is determined and controlled by our brain's cognitive processing functions. In this view, perception and action is a linear feedforward process. Neither perception nor action play a direct role in reasoning processes. Furthermore, the modular theory of brain structure, which views brain functions as discreetly separate, implies that there is no feedback between perception and action because they are always mediated by the cognitive processes of the brain (Anderson, 2014, Barsalou, 2020). In this view what is valued most and given the greatest importance is the ability to reason. The reasoning process drives everything (Anderson, 2014).



Action & Perception in Embodied Cognition

Embodied cognition views the relationship between action and perception quite differently, starting with the assumption that the evolutionary role of brain development is to manage and guide our actions in the world and not to produce symbolic mental representations (Anderson, 2014). In embodied cognition action and perception establish reciprocal feedback loops. “Rather than operating independently of one another, perception, cognition, bodily experience, and action are tightly coupled, working together to produce effective action in the world” (Barsalou, 2020). Action and perception are not isolated from each other by the representational system of the brain, instead, they dynamically interact with each other (Varela et al, 1991/2016; Chemero, 2009; Anderson, 2014). As we move in the world, our actions generate opportunities for perception, while the features we perceive through those actions, in turn, create possibilities for further action. From this perspective, perception and action are not separate processes but are tightly interwoven and embedded within the context of the environment (Varela et al, 1991; Shapiro, 2019).

In enactive cognition, thinking is grounded in the experiences that emerge from sensorimotor interactions, emphasizing our capacity to engage with the environment. Action, however, is not just restricted to physical movement, but is more broadly interpreted as goal-oriented behaviour. Our actions support our ability to perceive the world in a way that will enable us to achieve our goals (Anderson, 2014; Engel et al, 2015, Barsalou, 2020). The environment offers affordances as potentials for action, that an individual will focus their attention on, and this will guide their actions and their thinking processes. The affordances of the environment play different functional roles and offer complementary contributions to the achievement of goals. (Gallagher, 2023)



Action & Perception in the Artmaking System

The first level of analysis for the participant demonstrations focused on tracking the artist's interactions with the elements of the artmaking system. The goal was to identify patterns that shed light on what the artist was doing, how they engaged with the subject, the materials, and the artwork as it evolved through time. This analysis revealed recurring patterns of action and perception that were related to the different goals of the artmaking processes. Using the artmaking demonstrations from the case studies of Michael and Claudine, this section will illustrate how the action-perception cycles, which are central to embodied cognition, reflect the dynamic relationship between the artist and the elements of the artmaking system.

Action & Perception: Participant Case Studies

Case Study with Michael.

Michael's demonstration lasted approximately two and a half hours during which he created a small still life painting from start to finish. The still life subject is an old tube of paint with a reflective sheet of plastic paper in front of it. Michael's finished painting depicts the distorted reflection of the paint tube. Michael's artmaking system is comprised of his chosen artmaking subject which is a still life set-up; the materials are primarily oil paint and the related tools such as brushes and palette, and a small canvas board with the evolving composition that resulted in a finished still life painting.

Figures 7.3 - 7.6 are sequential photo frames taken from the video of Michael's artmaking demonstration, illustrating the action-perception cycles that occurred during his artmaking process. The photos depict Michael sitting in front of his easel, working on his painting. To his right is a table containing his palette, paint, brushes, rags, and a metal wash tub. To his left is the still life setup that serves as the subject for his painting. The photo frames depict four recurring interactions of Michael with the elements of his artmaking system:

- 7.3: Artist-material interaction: Micheal is engaging with the materials by mixing colour on his palette.
- 7.4: Artist - artmaking subject: This interaction illustrates Michael observing the still life subject after mixing paint.
- 7.5: Artist-materials-artwork: After observing the still life - subject, Michael engages in a material action by applying paint to the canvas.
- 7.6: Artist-artwork: Michael pauses and leans back to assess what he has done.



7.3. Artist - material interaction



7.4 Artist- artmaking subject interaction



Figure7.5: Artist-material-emerging artwork interaction



Figure7.6: Artist-emerging artwork interaction

When Michael engages with the materials, mixing paint and loading his brush, he then turns to observe the still life. This action-perception sequence forms the basis for the next sequence, in which he adds a stroke of paint to the canvas and then observes the outcome. His bodily interactions with the materials and the transformations in the painting lead to new perceptions, initiating another cycle of action and perception. This creates a reciprocal feedback loop that persists throughout the entire process. Changes in one aspect, such as the canvas, influence his observations of the still life subject, which in turn affects his interactions with the materials, establishing an ongoing cycle of interaction and adaptation (Fuchs, 2020; Gallagher, 2023). The sequence of actions depicted in figures 7.3 to 7.6 are one example of a consistent pattern of repetition that was observed throughout the painting session. Based upon this, it becomes possible to infer the intentional structure of Michael's embodied thinking and action as it pertains to the painting process.

As Michael engages with the still life subject, the painting materials, or the painting, his perception is not passive but goal-directed (Varela et al, 1991/2016; Noë, 2004). When he turns to observe the still life, he is looking for specific information that is connected to the needs of the

painting. As he actively probes the environment for relevant information, he is attuned to the affordances within the elements of the artmaking system, perceiving opportunities for action. His interactions with the still life subject, the paint and the emerging painting shape what he perceives, establishing a complementary relationship between the elements of the system and the perception-action cycles that progress throughout the evolution of the artmaking process. The still life setup, the paint, and the painting are complementary affordances for the ongoing painting process, for his actions and his thinking processes. Each element plays a different role in how he thinks and acts throughout the process (Gallagher, 2023).

An affordance is something that exists both in the environment and in the individual, making it both objective and subjective (Gibson, 2015/1979; Searle, 2016; Fuchs, 2020). Although the environment may furnish many affordances as potentials for action, affordances are relational and relative to a specific individual. How one individual perceives and uses an affordance will not necessarily be the same as someone else (Chemero, 2009). Affordances also exist within the individual as knowledge and skills, which implies that as opportunities for action, affordances depend upon our learned sociocultural practices (Rietveld & Kiverstein, 2014).

As I watched Michael paint, I was intrigued to discover that certain aspects in his approach to painting were similar to my own, while others were quite different, especially with regards to colour and the treatment of light and shadow. For example, where he used dark neutral colours to represent shadows, in my painting practice I tend to look for warm and cool colour relationships to represent light and shadow. In other words, I perceived the affordances of the subject and the paint differently than Micheal did.

In enactive cognition the reciprocal relationship between perception and action is described as sensorimotor contingencies. According to O'Reagan and Noë (2001), seeing is not a passive activity that happens in the brain, it is something that we do, and sensorimotor contingencies are a skilled way of perceiving and interacting with the environment. In other words, knowing what to look for, which affordance in the environment is relevant to the task at hand, is a skill that is developed over time.

The ways that Michael interacts with the elements in his artmaking system represent a set of strategies that are used to achieve the chosen goal. The various sequences of looking at the artmaking subject then the artwork; artwork and the materials; the artmaking subject then

materials are intentional perception-action cycles that enable the artist to observe and find the information that is relative to their goals. These strategies are examples of how sensorimotor contingencies are connected to the relational affordances that exist between the artist and the other elements of the system.

Case study with Claudine

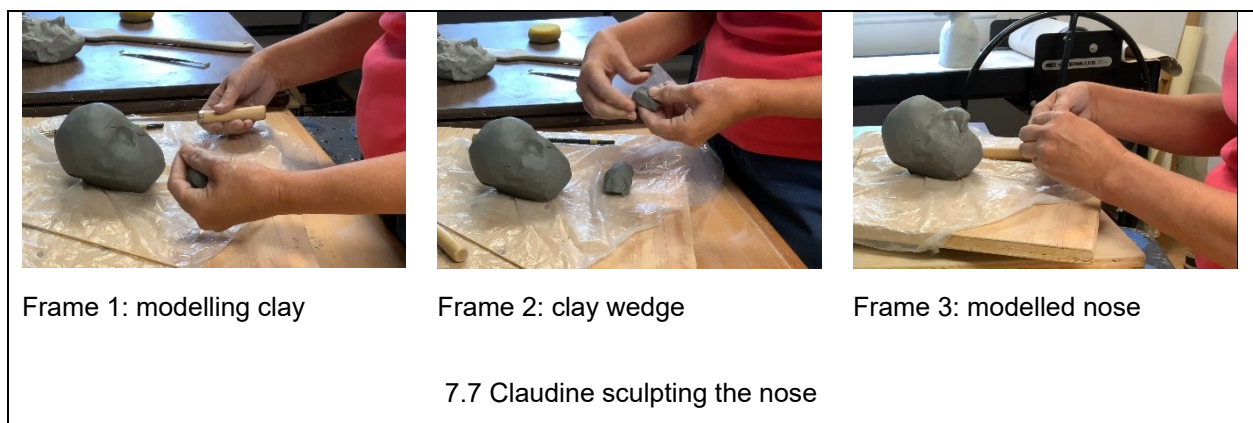
For her artmaking demonstration, Claudine chose to create a three-dimensional portrait in clay. Claudine approached the demonstration as an exploratory process. She had no preconceived notion of how the portrait should look; it was not meant to resemble a specific person. Unlike Michael, who worked from direct observation of a still life subject, Claudine worked from memory and imagination. Claudine's process as an artmaking system includes her concepts of art; clay, a clay slip, and modelling tools are the materials; the concept of a human portrait is the artmaking subject; and the emerging artwork is the three-dimensional portrait that evolves into the final piece. Claudine's demonstration is an interesting challenge for theories of embodied cognition and opens the discussion about the role of mental representations. The lack of a visible subject reference would support the classical cognitive view of internal mental representations.

In classical cognition, mental representations are theorized as amodal symbolic structures constructed by the mind. For example, after a visual stimulus is observed, the brain transforms it into an amodal symbolic form that is used for cognitive operations. The perception–action process is understood as a feed-forward system. It begins with perception as a passive, bottom-up process, followed by cognition, and concludes with action as a top-down response. In this framework, the creation of a portrait sculpture starts with a mental representation of the intended portrait. The process is planned, with intentional content formulated cognitively using amodal concepts of the portrait, clay, and processual knowledge of sculpting. This information governs the motor commands in the execution of the process. The artist's skilled actions are viewed as non-cognitive. This perspective draws a clear distinction between the mind, located in the brain, and the material actions involved in artmaking, which are seen as separate, mechanical outputs.

Embodied cognition challenges the theory of amodal symbols, which argues that mental representations are entirely abstract and disconnected from the body, perception, and action. Lawrence Barsalou (2020) has proposed a compelling alternative, known as the theory of Perceptual Symbol Systems, which posits that mental representations and conceptual

knowledge are grounded in perceptual experiences, such as image schemas. According to this theory, mental representations are not amodal, nor are they detached from sensory and motor experiences, rather, they are constituted in sensorimotor interactions. This view posits that cognitive representations function as neural simulations of past experiences (Barsalou, 2016, 2020; Friedenberg et al., 2020; Johnson & Tucker, 2021). This framework supports the theory that cognition is multimodal, involving the activation of various sensory and motor systems in the brain. This happens not only during direct engagement with the world but also during off-line thinking, when individuals mentally simulate experiences that are not currently present. In essence, embodied experiences remain grounded in the neural systems of the brain where they initially occurred, making cognitive processing dynamic and interactive (Barsalou, 2016; Palmiero et al., 2019; Johnson & Tucker, 2021). When we recall something from memory, we activate the neural connections that have been strengthened through time and repetition.

When Claudine takes a piece of clay, models it into a triangular wedge (Frame 1, Figure 7.7) and then integrates it onto the centre of the face (Frame 2), she is re-enacting her concept of the three-dimensional shape of the nose. (Frame 3). This is an action that she has repeated countless times in previous sculptures. Her skillful actions were guided by both her memory of having modelled other noses in clay and her action-perception cycles in the current process as it unfolds through time and space.



The sequences of action - perception observed during Claudine's demonstration included modelling the clay, observing the sculpture, placing the piece of clay into position, and then integrating the clay by smoothing it into the surface. Each action-perception cycle leads to reciprocal feedback. As the process unfolds through time, each move includes a retention from

the previous move and a projection to the future; each act is influenced by the previous one and determines the next one (Malafouris, 2019).

Over time, Claudine has developed sensorimotor contingencies that enable her to perceive and act with the clay to form a portrait and develop all the concepts that are embedded in her understanding of a three-dimensional portrait. These concepts are constructed through time and space, through material engagement, through her situated experiences of the sociocultural practices that are part of sculpting and making art. (Rietveld & Kiverstein, 2014; Alessandrini et al, 2024).

According to the Varela et al (1991/2016), “cognition as sense-making is the exercise of skillful know-how in situated and embodied action. Cognitive structures and processes emerge from and constitutively depend on recurrent sensorimotor patterns of perception and action” (p. xxvi). In the case of Claudine’s portrait demonstration, sense-making is real-time thinking, problem-solving. and goal directed behaviour that is integrated into the ongoing interactions between the clay, the emerging sculpture, and her embodied concepts of sculpting the portrait.

Summary

Action and perception are fundamental aspects of the art-making process, but they are often overlooked when studying artistic thinking. This oversight is particularly evident when viewed through the lens of classical cognition, which presumes that perception and action do not play an active role in thinking processes. In contrast, embodied cognition asserts that action and perception are integral to thinking, operating through complementary and reciprocal loops rather than following a linear, feed-forward process. The aim of this section has been to emphasize how the action-perception cycle functions within the art-making system. As a dynamic system, artmaking is an open-ended goal-oriented process where each element of the system contributes to the thinking processes involved. Through perception, the artist actively explores the elements for relevant information that will lead to material actions.

For instance, when observing the still life subject, Michael looks for specific information that will inform colour mixing. Each material action, such as creating painted shapes, provides added information that Michael can perceive and evaluate, establishing a feedback loop of reciprocal causation.

The elements of the artmaking system have affordances that the artist selectively thinks and acts with when developing the artwork. Each element plays a distinct and vital role in the

artist's thinking processes. For example, the clay affords three-dimensional modelling, while Claudine's hands and simulations of facial anatomy afford sculpting a portrait. The affordances of the artist, witnessed through their skilled interactions, establish a complementary relationship between the elements of the system.

Key principles of embodied cognition, such as reciprocal and complementary action-perception cycles, the relative affordances of system elements, sensorimotor contingencies, and neural simulation, will be explored in the following sections. These principles will help us understand how artistic thinking can be modeled as an embodied material process. The next sections will investigate the modalities of the artistic thinking model through the participants' art-making demonstrations and examine how the Artistic Thinking Model (ATM) can be integrated into the art-making system.

Chapter 8. Research Findings: Visual Thinking.

Introduction.

When Arnheim wrote *Visual Thinking* (1969), his objective was to demonstrate that artistic thinking is a complex cognitive process that is fundamentally visual. The main thrust of his arguments is that cognition and perception are not separate processes, but that perception is essential to our ability to think and conceptualise. He challenged the dominant paradigm of cognitive science and the computational theory of mind that viewed perception as passive and cognition as the manipulation of abstract symbol systems. Arnheim insisted that thinking depends more on perception and visual imagery than on words, thereby collapsing the binary between “seeing” and “thinking” espoused by classical cognition. His theory that perceptual and conceptual systems are mutually dependent on each other, was later fully developed in the theories of conceptual metaphors. (Lakoff, 2006). Although Arnheim’s theories of visual thinking were focused on internal mental processes and did not incorporate the body’s role in cognition, his work has remained foundational to our understanding of visual thinking in the visual arts.

Arnheim’s interest in our ability to represent concepts visually rather than verbally is developed in the work of Barbara Tversky (2005, 2014) who studied how spatial reasoning, visual diagrams, and gesture reflect deeper cognitive structures. Tversky’s research suggests that visual thinking is not merely a mental act but one grounded in interaction with space, where gestures and visual-spatial representations serve as cognitive tools. According to Tversky, visual communication, whether it is in the form of realistic depictions, or informational graphics, is a process that includes collecting information, applying different types of reasoning processes to the information and then communicating it through visual depictions. She calls this visuospatial reasoning. What makes visual thinking and visual perception uniquely important to the visual arts is that not only is thinking visual, thoughts and ideas are also visually communicated (Ware, 2021).

The previous chapter laid the groundwork for understanding the embodied nature of visual thinking through the reciprocal and complementary interaction of action and perception. This chapter will examine visual thinking as perceptual problem solving in the artmaking demonstrations of the participants to understand how artists perceive, select, organise and construct the visual/spatial structure of the artwork.

The artmaking subject as a source of visual information.

The elements of the artmaking system are resources that contribute to the realization of the system's goal which is an artwork. As resources, the elements have various affordances, such as providing information or intentional content for what and how the artist thinks during the process. This section begins by examining the artmaking subject as a source of information that affords the action-perception thinking processes of artmaking.

As a source of information, the artmaking subject is one of the elements of the artmaking system that is used to frame the ideas, questions and problems of the artmaking process. Based on the interviews with the artists, what became apparent was that the artmaking subject could be described in numerous ways. I differentiated how the artists describe their work into three categories: a topic of inquiry, visual resources, and a visual subject. Each category describes the artmaking subject based on the type of information it contributes to the visual structure of the work. A topic of inquiry refers to a concept or theme that the artist is exploring. It may or may not have a visual structure at the beginning of the process. Visual resources are forms of visual information that the artist uses to develop the visual structure of the artwork, and the visual subject is the visual form that the artist is creating. The relationship between the topic of inquiry, the visual resources and the visual subject may be direct or indirect, and one of the challenges of the artmaking process is to arrive at some level of conceptual integration across these categories. Table 8.1 illustrates the relationship between the topic of inquiry, the visual subject and the visual resources that the participants used to create the artwork. I have further broken down the types of visual resources that the research participants used to create their artworks into the following three categories:

- A direct visual reference.
- Multiple visual references.
- Imagination or memory.

The relationship between the visual subject and the visual resources will be the focus of the discussion and analysis of the following sections.

The artmaking subject: a direct visual reference.

A subject that is directly observed offers information that the artist can use for the purposes of creating the work. During the artmaking process, the artist will select the information available in the visual reference to represent what is considered relevant to the

goals of the process. This will be reflected in the emerging artwork as well as additional information that the artist chooses to add. Michael and José used direct visual references in their artmaking processes. Michael composed objects into a still life subject for the visual reference of his painting. José used digital photographs of missing people that were the visual reference for the drawings that he created.

Table 8.1 The resources for the artmaking subject			
Participant	Topic of Inquiry	Visual resources	Visual Subject
Michael	Visual experience distortions	Direct observation of still life subject.	Reflection of an old paint tube
José	Artistic identity & physical presence	Digital photos from Missing persons databank.	Portraits of missing persons
Mary	Adolescent adventures & pop culture	Photos of family members, studies, imagination.	Adolescents finding a mysterious object at night
Genevieve	Empathy for physical & psychological struggles	Magazine images, imagination.	Abstracted & fragmented body parts
Claudine	People & dolls	Memory & imagination	Portrait head

The artmaking subject: comprised of multiple resources.

The artist gathers various sources of visual information and organizes it into a complex composition. I use ‘complex composition’ to refer to the different resources that the artist uses to compose the artwork. The reference material acts in similar ways to the first case of direct observation. The artist will observe and choose information that is relevant for the goals of the process. However, in this case, the relationship to the original source material becomes increasingly indirect and more difficult to discern when looking at the final artwork.

Mary and Genevieve used various visual references to construct and compose their respective paintings. When working with multiple resources, the artist may go through a deliberate planning process that will include preliminary studies. This was observed in the

painting that Mary created. It may also be a spontaneous process where the artwork is progressively composed during the artmaking process, as was demonstrated by Genevieve.

The artmaking subject: memory and imagination

In this category, there are no visible resources present, rather the process relies on memory or imagination. This is different from working from direct perception: there are no external visual cues regarding the subject of inquiry. Visual structure progressively emerges and relies on a dialogue between the materials, the emerging artwork and the artist's memory and imagination as it pertains to the artmaking subject. In the case of Claudine, there was no visible visual resource used to scaffold the process. The composition was progressively generated as the process unfolded.

Visual Thinking: Case study with Michael.

This section will analyse the visual thinking processes that are used to transform the artmaking subject into the emerging artwork. I will begin with Michael's artmaking demonstration because it is possible to visibly map the relationship between the artmaking subject, the materials, and the emerging artwork through the action/perception cycles of the painting process. As previously outlined, Michael is creating an oil painting of a still life from direct observation. The still life set-up is an old tube of paint on a flat surface, with a reflective sheet of paper in front of it. (figure 8.1) The painting depicts the distorted reflection of the paint tube. Michael's painting process went through three stages of development:

1. Initial line drawing.
2. Colour block-in.
3. Refinement of composition with smaller details.

The artmaking process begins with a simple skeletal structure to establish the general outlines of the composition. The rest of the work builds upon these foundations by progressively adding information to elaborate and refine the initial visual structure. In other words, Michael's strategy begins with a simple schematic outline that becomes increasingly complex as the painting progresses.

Initial line drawing:

Michael begins the artmaking process with a semi-blind contour drawing in pencil, that is executed as a continuous line drawing. While drawing the semi-blind contour Michael observes

the still life subject, while his hand and pencil rhythmically move across the canvas to create a continual outline that will function as a visual framework for the painting to come. He occasionally looks at the drawing, but his observation is focused on the still life subject. Figure 7.1 is a photo of the still life subject and the finished line drawing.

This is a visual priming for the painting process, facilitating an initial understanding of the overall compositional structure and its position on the canvas. Michael is making sense of what he is observing in real time through the action/perception process of drawing (Noë, 2004). He is making sense of how to proportion, organize and place the elements of the composition on the flat two-dimensional surface of the canvas.



Figure. 8.1: Still life subject

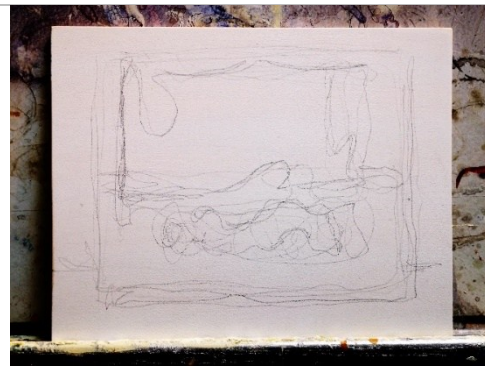


Figure.8.2: Initial line drawing

This initial drawing can be considered as subsidiary knowledge, or a background skill that is integrated into the more complex skill of painting (Polanyi, 1966; Searle, 2004). The execution of a semi-blind contour brings together the subsidiary skills of observation, hand-eye coordination (kinesthetic abilities), as well as understanding what to look for in order to depict the outlines of forms, how to gauge relative proportions and how to synthesize different elements into a whole. It demonstrates that the ability to paint from direct observation builds on the ability to draw from direct observation.

For Michael, this brief 2-minute act of laying down an initial drawing integrates visual/spatial reasoning abilities such as abstracting and schematizing information. and synthesizing the individual components into a unified whole (Tversky, 2014; Carvalho & Goldstone, 2016). Abstraction, in this context, refers to “a mental activity by means of which parts of a unit are detached from the whole, and separate qualities, color, form, etc. are experienced in isolation” (Cupchik, 2016. p 33.). Abstraction is not the elimination of concrete,

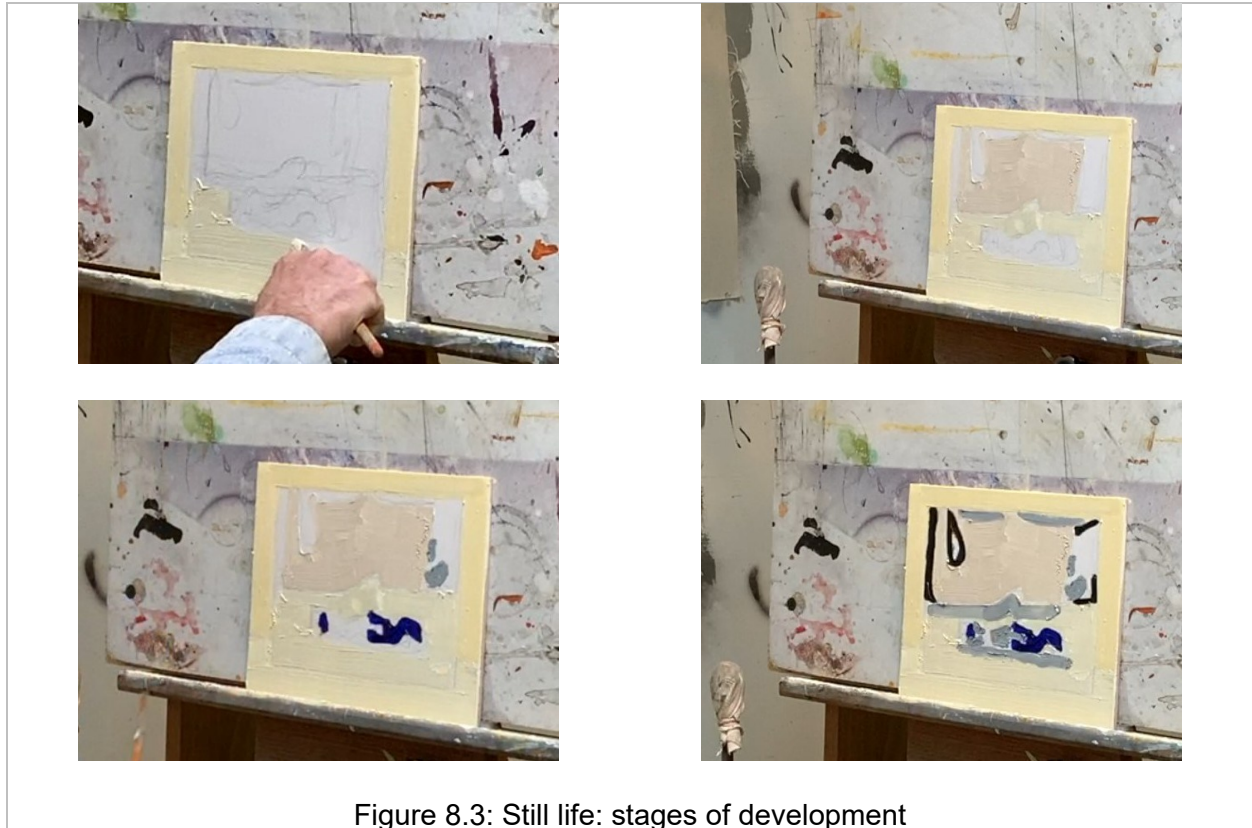
sensorimotor experiences, it is the ability to analyze and discriminate the experiential, visual aspects that are the most relevant to the task at hand. According to Arnheim (1969), the ability to distill the most relevant features from experience is the central feature of abstract thinking.

Michael's visual focus is on the external contours of the background, foreground, and paint tube and the relative proportions of these elements. The forms are simplified and reduced to rhythmic lines that communicate the contoured edges of what he is perceiving. The formal simplification and absence of detail results in a structural abstraction of the observed still life subject. Michael is isolating the relevant structural features that are critical to the ability to grasp the composition (Arnheim, 1969). The continuous rhythmic lines that repeat around the two-dimensional surface of the canvas unify the individual components into a compositional whole. Goldstone & Byrge (2015) describes this visual reasoning process as unit perception, or the ability to visually synthesize disparate objects into a unified whole.

During the painting process, Michael continues to schematize the subject. Whereas in the initial drawing he focused on the linear structure of the compositional elements, during the painting process, he focuses on articulating solid shapes. Each element of the composition is decomposed into simple abstract shapes that are rendered with broad decisive brushstrokes, heavily laden with paint. Each shape is assigned a specific size, colour and tone of paint. In the first phase of the painting process, where he is blocking in the composition, the subject emerges like pieces of a puzzle that are gradually assembled together (See Figure 8.3).

Analogical reasoning.

According to Tversky (2014), when we construct visual depictions, we are using analogical reasoning to map visual/spatial structures onto a pictorial space. Analogical reasoning uses structural correspondences between source and target domains, or between the artmaking subject and the visual structure of the artwork. (Jonassen, 2011; Tversky, 2014; Lovett & Forbus, 2017). Visual / spatial depiction preserves certain features and properties of the perceived world. Visual properties are shape, colour texture, whereas spatial properties are direction, path and movement (Tversky, 2014; Ware, 2021). In art education, these are commonly referred to as the elements of art and principles of design. Unlike verbal communication, which relies on the arbitrary symbol systems of language, visual art relies on visual and spatial forms of construction that bear some resemblance to the visual environment that we observe and experience. (Tversky, 2014; Ware, 2021).



Michael is constructing an analogical visual correspondence to what he is observing. A visual correspondence is not an isomorphic relationship; it is not a copy (Malafouris, 2013). Visual processing includes the decisions that are made regarding the selection and omission of information, as well as the addition or exaggeration of information (Tversky, 2008, 2014; Kozbelt & Ostrofsky 2018).

The ability to look at something and decompose it into smaller constituent shapes and then synthesize it into a whole is a particular skill in perceptual thinking. Not only is Michael doing this with the visual subject that he is observing and then depicting in the painting, but he is also doing this with colour. Each colour that he mixes requires him to be able to articulate a specific hue, tone and saturation. Carvalho & Goldstone, (2016) point out that this is a complex visual processing ability that most people are not able to accomplish and takes considerable time and practice to learn.

Visual thinking as top-down and bottom-up reasoning.

Michael's progressive deconstruction and synthesis of the still life subject into the drawing and painting is a cognitive strategy that incorporates bottom-up and top-down reasoning

processes. In Classical cognition, visual perception and visual thinking are separate but connected processes. Perception is a passive bottom-up process that collects raw sensory information. This information is fed forward into the brain which encodes it as amodal symbolic mental representations. Top-down reasoning refers to the interpretation of perceptual information using internal knowledge such as schemas and concepts. Mental representations are then further converted into motor representations that determine bodily action. Perception precedes thinking, whether the thinking output is visual, verbal or in the form of an action. Furthermore, cognitive processes are always brain-bound processes requiring symbolic structures that are disassociated from the body (Anderson, 2014; Pezzulo et al, 2017; Barsalou, 2020).

In embodied cognition, the brain does not mediate perception with the goal of creating a disembodied mental representation, it guides perception. This means that perception as a bottom-up process is an active engagement with the environment. Looking and observing are acts of exploration (Noë, 2004, Anderson, 2014). Top-down reasoning processes are grounded in body-based schemas that are developed through interaction with the world. (Lakoff & Johnson, 1980; Lakoff, 2018; Johnson, 2017). These schemas are body-based experiential patterns that are grounded in sensorimotor experience and stored in the brain as multimodal neural encodings, that are then enacted through neural simulation (Barsalou, 1999, 2020; Lakoff, 2018; Johnson & Tucker, 2021). Rather than being controlled and mediated by mental representations, thinking is multi-modal. There is a direct connection between the visual and motor areas of the brain. Top-down reasoning is based on prior action-perception experiences. In this view visual perception is already visual thinking (Noë, 2004; Anderson, 2015; Pezzulo et al, 2017; Barsalou, 2020).

In the context of artmaking, bottom-up and top-down reasoning can be understood as complementary cognitive strategies that reflect the dynamic interplay between perception, action, and intention. Throughout the artmaking process, Michael is applying methods of visual thinking that he has developed through his many years of practice in drawing and painting. This includes knowing where to focus his attention when constructing the different elements of the composition, selecting specific visual/spatial features and ignoring others, extracting relevant information, simplifying it into schematic content, using a systematic approach that develops the composition starting from large areas then drilling down into smaller details that results in the synthesis of the overall composition. These top-down visual thinking processes are applied and synchronized with bottom-up perception of the specific subject throughout the painting process.

Action Perception cycles

What is informative about Michael's demonstration is that it is possible to follow how he is mapping his perception of the still life subject onto the canvas, first through the lines of the initial drawing, then through paint. Furthermore, through his actions, it is possible to understand what he is observing and analyzing at any moment during the process, making the relationship of perception and action visible and apparent. In the first phase of the painting process, which lasted about one hour, Michael uses the following action-perception routine:

- Observe subject - mix paint and load brush.
- observe painting and position brush.
- observe subject & apply paint.

After several rounds of this sequence, Michael pauses, leans back and observes the painting. This pause for assessment lasts a few seconds. When he observes the subject, he is looking for specific information that will inform the painting process, which reflects the goal-oriented nature of perception. When he mixes a specific colour of paint and loads the brush, he is devising a visual correspondence between what he has observed in the still life subject and the materials. He then looks at the painting to determine where he will place the next brushstroke, but before making a mark, he refers back to the subject to confirm what he is visualizing with regards to the still life subject, then he decisively adds the paint. During the second phase of the painting process, or the refinement phase, the action perception sequence is modified into:

- Observe subject - mix & pickup paint
- Observe painting - observe subject
- Apply paint
- Pause to observe painting.

Unlike in the block-in stage, in this stage, Michael pauses to observe the painting after almost every application of paint. The brush strokes and paint application are more refined. He uses smaller brushes and a mahl stick to steady his hand as he adds certain details. The second stage takes as long as the first stage, even though he is only making minor changes to the painting. In the refinement phase, Michael spends more time visually interacting with the emerging painting, carefully determining what it requires before adding paint. The move from visual perception to material action is a process of mapping information from one domain to another, from visual experience to materials (Tversky, 2014). The next section will examine the

notion of visual mapping to gain a better understanding of the perception action cycle and how visual thinking leads to material thinking.

Visualisation and projection

David Kirsh (2009, 2013) has studied how people interact with their surroundings to make sense of situations and solve problems. Using an extended cognition framework, he examines how individuals use tools and other elements in their environment to help them think and create. According to Kirsh, when drawing from observation, an individual will incorporate an iterative sequence of perception and action that he describes as observe- imagine- project.

Observation depends on a visual stimulus, such as observing something in the environment. Imagine refers to a mental representation of something that is not present. When we visualize or imagine something, it can be altered or manipulated in the mind. Projection is concerned with going beyond what is observed and visualized in the imagination because it results in the physical creation of structure. Here is how Kirsh (2013) makes the distinction between imagination and projection:

“Projection is a mental process akin to attaching a mental image to a physical structure. When we project onto an object, whether kinesthetically or visually, we experience ourselves intentionally augmenting the object. The object anchors our mental image, and successful projection requires spatially or temporally locking the projected image onto the anchoring structure...When we imagine an object, we again are dealing with mental images but we do not attach them to anything in the external world. Imagination has no physical anchor, and imagined images need have no specific size or location.” (Kirsh 2013. p: 3.18)

When painting from direct observation, Michael will visually search for information. For example, Michael looks at the still life subject to select information regarding the shape and colour of the paint tube. This information is visualized (in his mind) as a geometric shape. Projection is determining the proportions, colour and spatial location of this shape relative to the emerging artwork. When Michael takes the decisive action of making a mark with the paint and brush, he is anchoring the projected visualisation onto the painting.

When the visualized shape is projected, it is projected onto something in the world, which Hutchins (2005) calls an external anchor. In other words, a projection relies on some type of

external structure (Kirsh, 2009, 2013; Malafouris, 2013, 2021). Projection and anchoring onto an external structure describe the move from observation to visualisation, then to materials, or how visual thinking is structurally coupled with material thinking. Whereas Kirsh uses the term projection, Tversky (2014) uses the term mapping. Both terms imply the association of visual structure with embodied action and materials.

The processes of observation-visualization, and projection-anchoring that are part of the action-perception cycle used by Michael during the painting process are illustrated in figure 8.4. The chart has two columns, the left column illustrates the elements of the artmaking system that he is interacting with, the right column illustrates his action-perception cycle.

Observation: the first row illustrates Michael observing the still life. His observation is targeted and goal oriented as he perceives the affordances of the still life.

Visualization & Projection: Michael turns his attention to the palette. As he uses his brush to pick up paint, he is visualizing and projecting the information that he has observed in the still life.

Anchoring: The third row of the chart illustrates that Michael's attention is focused on the emerging artwork. When Michael applies the paint to the canvas, he is anchoring the shape that he has visualized and projected onto the materials.

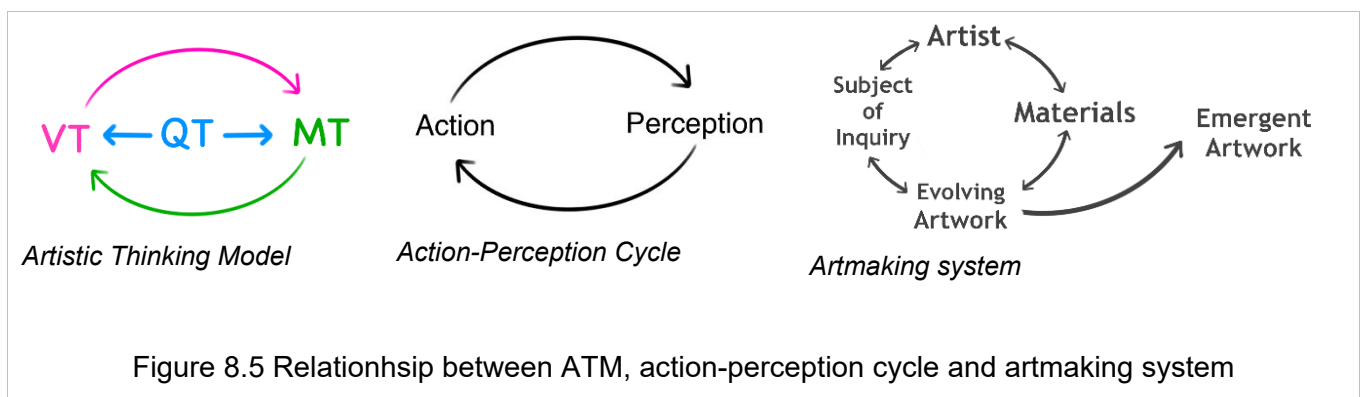
Figure 8.4: Example of Visualization, Projection, and Anchoring.

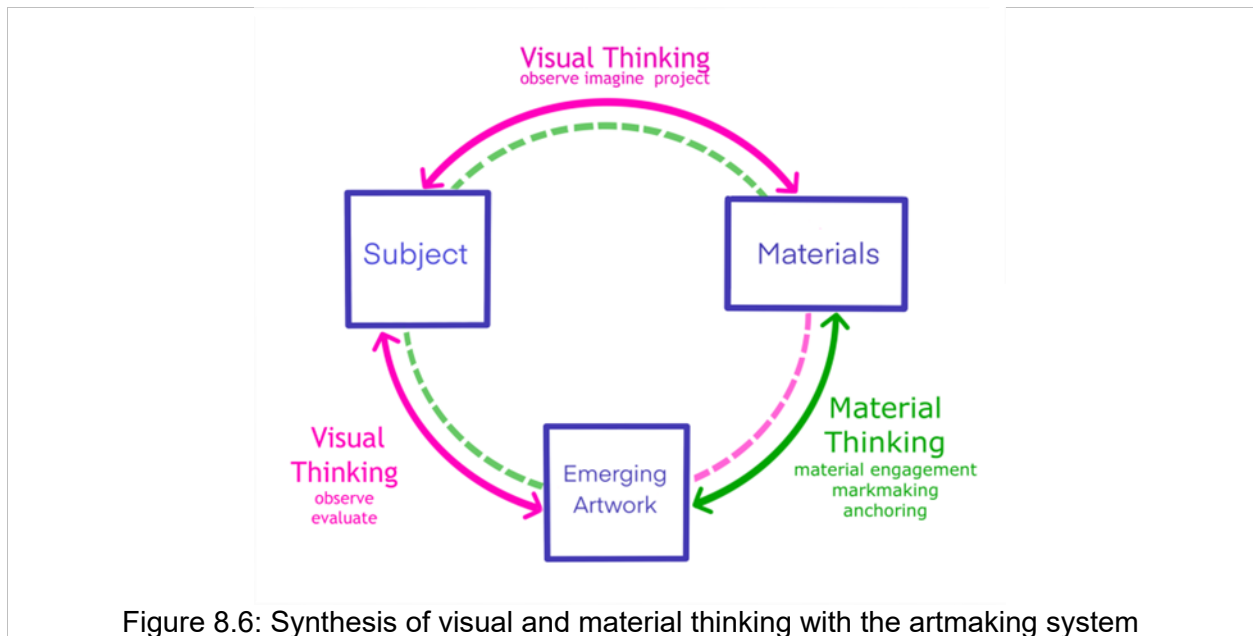
		Observe: Observation is targeted and goal oriented to gather information. Michael looks at the right to observe the paint tube reflection (Still life photo to the left)
		Visualization and projection: Michael visualizes information as a specific geometric shape with definite proportions and colour. He mixes and picks up paint. (Materials shown on the left.)
		Anchoring: Mark-making with paint and brush on the anchors what is visualized onto the painting surface. Emerging painting on the left.
		Feedback & evaluation: Michael pauses to observe the painting to evaluate its progress and determine what to do next.

Feedback & Evaluation: Michael pauses to observe the painting and evaluates how it is progressing. This interaction of the artist with the emerging artwork illustrates the role of feedback in the artmaking system. The case study of Michael's painting process offers an initial step to understanding how visual and material thinking from the ATM can be integrated into the artmaking system.

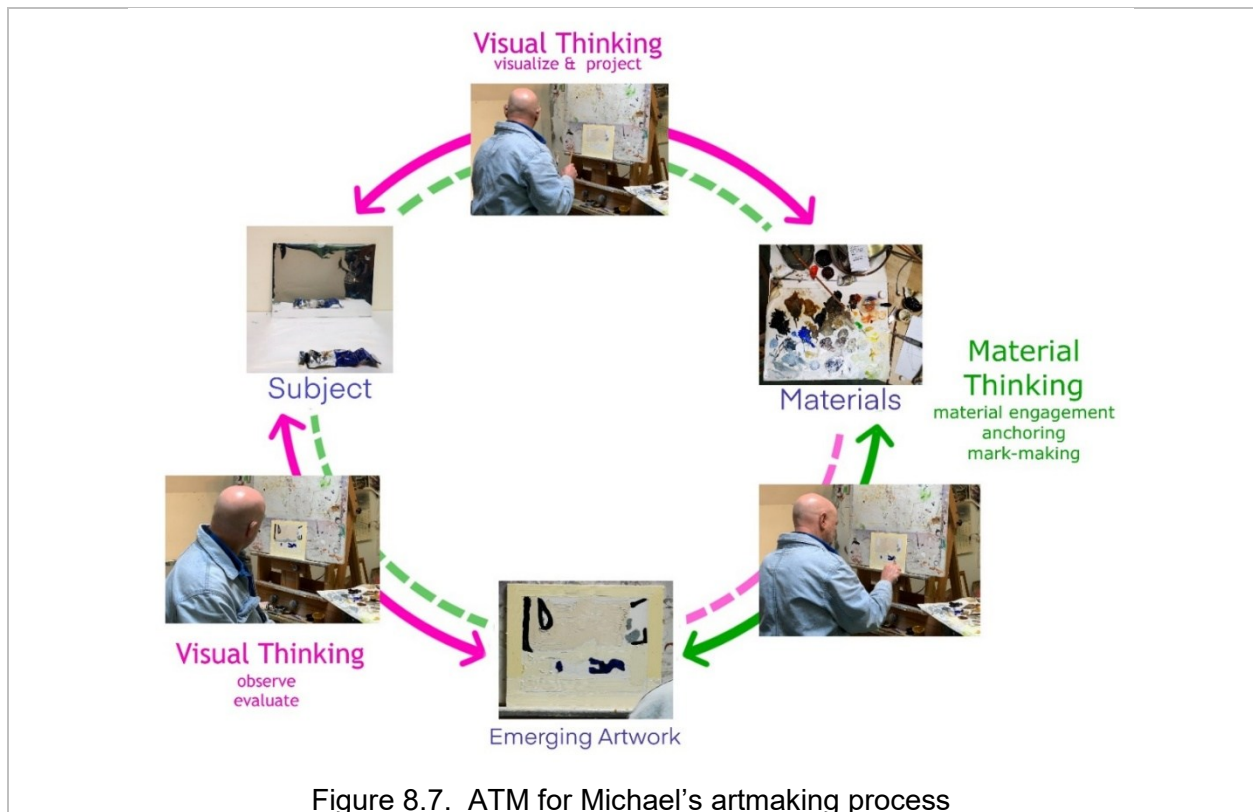
In the ATM, visual thinking and material thinking are conceptualised as reciprocal processes that are iterated throughout the artmaking process. (Figure 8.5a). In the previous chapter, the embodied action-perception cycle was used to describe the general pattern of interaction of the artist with the different elements of the artmaking system during the artmaking process (figure 8.5b). The action perception cycle of embodied cognition can be integrated into the ATM through the relationship of visual and material thinking, and this is then integrated into the artmaking system (Figure 8.5c).

Figure 8.6 illustrates how visual and material thinking integrate with the artmaking system. The elements of the artmaking system: the subject, the materials and the emerging artwork are connected by Visual Thinking (red) and Material Thinking (green). The solid lines indicate which mode of thinking dominates when the artist interacts with the element, whereas the broken lines suggest that either visual or material thinking are still going on but are not the central focus at that moment. When the artist observes, visualizes and projects information to begin construction of the visual/spatial structure, visual thinking dominates. Projection leads to material thinking, when the artist engages with materials to anchor the visual/spatial information onto the emerging artwork. When the artist observes the emerging artwork, visual thinking again dominates, as the emerging artwork is evaluated with respect to the artmaking subject and goals of the process.





Visual and material thinking function through the perception action cycles of embodied cognition and as such they are reciprocal and complementary thinking processes that the artist uses to achieve the goals of the artmaking system. Figure 8.7 illustrates how visual and material thinking function in Michael's artmaking demonstration.



Visual thinking - Visualize & Project:

The still life as the artmaking subject, is a visual resource that has visual affordances for the artist. The visual affordances are the aspects of the subject that Michael perceives and uses for the painting process. These would include shape, colour, spatial structure, etc. When he actively observes the artmaking subject, he perceives information that he visualizes as a simplified geometric shape. The exact size and colour of the shape that he visualizes is projected onto the materials as he mixes colour and picks up the paint with his brush. This connects visual thinking with material thinking.

Material thinking - material engagement, anchoring & mark-making:

Through his brushstrokes, he anchors what he has visualized and projected onto the canvas. The emerging artwork reflects his visual and material thinking actions.

Visual thinking - observe & assess:

Michael observes the emerging artwork and the visual subject to assess and evaluate his actions and to determine what he will do next. These cycles of visual thinking and material thinking are iterated throughout the evolution of the painting process until the work is finished.

Visual thinking: Case study with Claudine

In Michael's demonstration, the artmaking subject is present and visible, making it possible to observe how he maps the visual subject onto the materials. The connections that he constructs between the visual subject and the artwork are relatively easy to follow. Claudine's demonstration offers an interesting point of comparison because there is no visual subject available for me to observe as she works. However, her subject matter is a human portrait, that she depicts realistically. Hence as an observer, although I cannot directly observe her artmaking subject, I use my knowledge of the portrait to follow her actions. Furthermore, having studied portrait sculpture in art school, I was able not only to follow her actions, but compare them to my own experiences and knowledge of the process.



Stage 1: Skull and feature development



Stage 2. Expressive details

Figure 8.8: Claudine: stages of portrait sculpture development

The goal of Claudine's artmaking demonstration is to create a portrait study in clay. The process went through two stages of development. In the first stage, Claudine creates the facial structure of a portrait, and in the second stage she goes on to refine the features to make the portrait more expressive (figure 8.8). The first stage of the process can be broken down into the construction of the anatomical features of the face. Claudine uses a logical progression which begins with the overall shape of the skull as a foundation upon which she builds the features. When creating a portrait, the facial structure has a certain symmetry that guides the placement of the features. She begins with indentations for the eye sockets and then goes on to place the shape of the nose. From this initial structure it is possible to position the other facial features.



Skull mass



Central features



Nose



Initial mouth structure



Chin



Cheeks

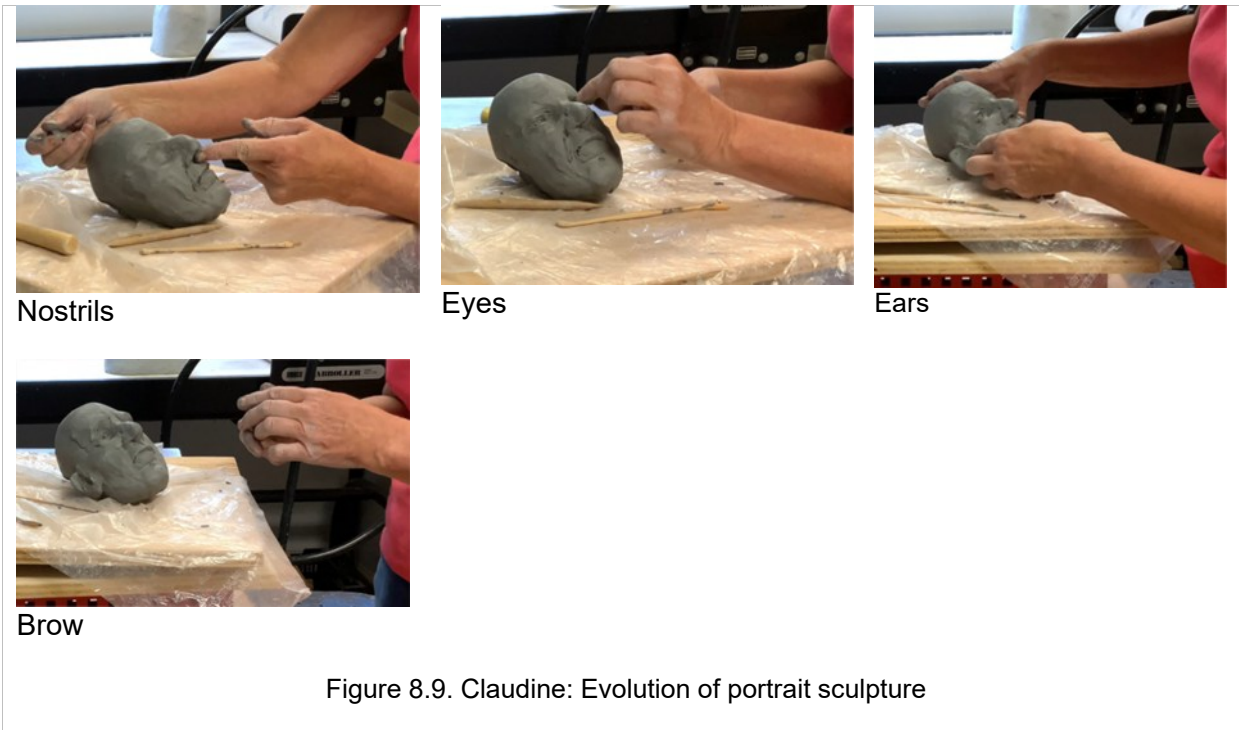


Figure 8.9. Claudine: Evolution of portrait sculpture

Analogical reasoning: mapping information across domains of experience

Like Michael, Claudine simplifies the elements of the composition, which in this case are the different facial features. Each addition to the portrait begins as an amorphous piece of clay that is modelled with her hands into a geometric shape. Each facial feature is schematized into a three-dimensional shape of clay, that when integrated into the whole represents a specific feature. For example, when she constructs the nose, she models a piece of clay into a triangular wedge, which she then integrates onto the face. In this way, she is using abstract schematics that progressively cumulate to become the complex structure of the portrait.

Figure 8.9 illustrates the first phase of the sculpture process and demonstrates how the sculpture evolves through the addition of the facial features. Claudine is using her conceptual knowledge of the human portrait and facial anatomy and her embodied procedural memory of how to realize the different stages of structuring a portrait sculpture. Unlike in the case of Michael's demonstration, the visual information that is scaffolding her process would be considered off-line thinking.

In classical cognition conceptual knowledge is modular, which effectively means that concepts can be studied separately from other brain functions such as perception and action.

Modularity however does not account for the role of other brain modalities that are crucial to the artmaking process, such as perception and action. A more comprehensive way to understand this process is through cognitive simulation and situated conceptualization (Barsalou, 2016, 2018).

In embodied cognition, conceptual development is grounded, meaning that concepts arise from sensorimotor experiences in the world. (Lakoff & Johnson, 1980). Concepts are dynamic and are distributed in the different modalities of the brain. “Within the human conceptual system, thousands of concepts represent diverse categories of settings, agents, objects, actions, mental states, properties, relations and so forth” (Barsalou, 2016, p.12). Concepts represent and determine how we interact and think about various categories of experience, and elements in the environment (Kiefer & Barsalou, 2013; Barsalou, 2016). A cognitive simulation is a reenactment of brain states that occurred when interacting with the concepts that make up a category. Key factors in understanding cognitive simulation and situated conceptualization are:

1. Thinking about concepts activates modal systems. Any element of a situated conceptualization can be a cue to activate a memory.
2. Conceptual processing instigates activity in sensory motor systems.
3. Conceptual representations are situated and context specific (Kiefer & Barsalou, 2013).

Throughout the demonstration, Claudine is thinking about the concepts that make up the category of the human portrait as well as the concepts that would be included in the category of sculpting with clay. She is simulating (or re-enacting) her past experiences. For example, when I asked her to talk about the sculpting process, this activated the concepts that represent the category of portraiture. Claudine describes the essential aspects that are involved in the creation of the clay sculpture:

“[T]he anatomy of the face requires the positioning of each element in relation to the head, and then in relation to each other, so marking the position of where eventually I would want the eyes and nose and a mouth to be, and then the relationship of those elements to the cheeks, the jaw, the forehead, etcetera...so the shape of the head or the positioning of the elements of face, the refining of those elements in relation to the other parts of the facial anatomy, the decision

about the emotion of the expression, and finally the refining to either exploit or correct that expression.” (Claudine, post-demonstration interviews)

Seeing the tool or material activates situated conceptualizations and simulated actions. In other words, the tool or material is a cue that activates her embodied episodic memory as sensorimotor simulations that are associated with it (Barsalou, 2016). Throughout the demonstration, Claudine is thinking about the concepts that make up the category of the human portrait as well as the concepts that would be included in the category of sculpting with clay. She is simulating (or re-enacting) her past experiences. For example, when she arrived at the point of creating the ear, this was a cue that activated her actions of making a flattened ovoid shape, which was followed by the observation of the sculpture to determine the exact placement. This is illustrated in figure 8.10, where Claudine looks over the head to gauge the placement of the ear relative to the eyes.

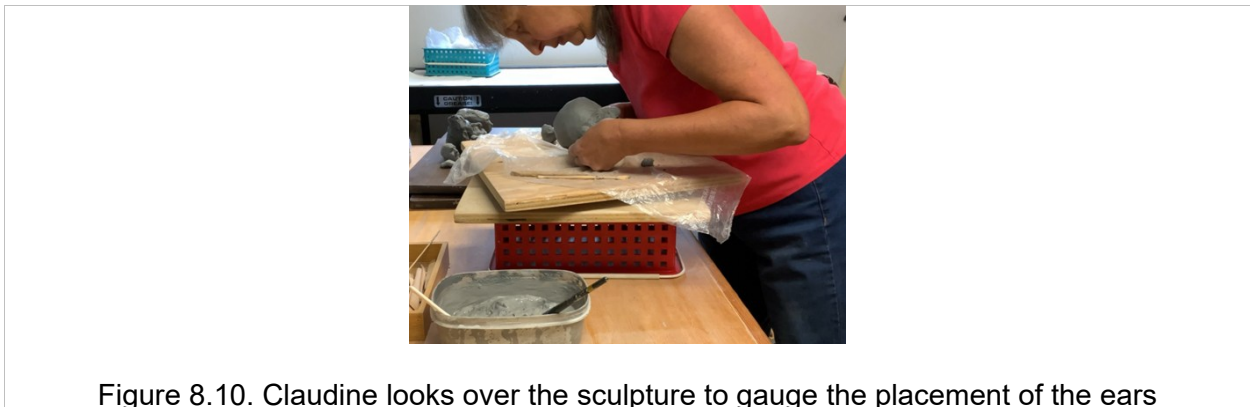
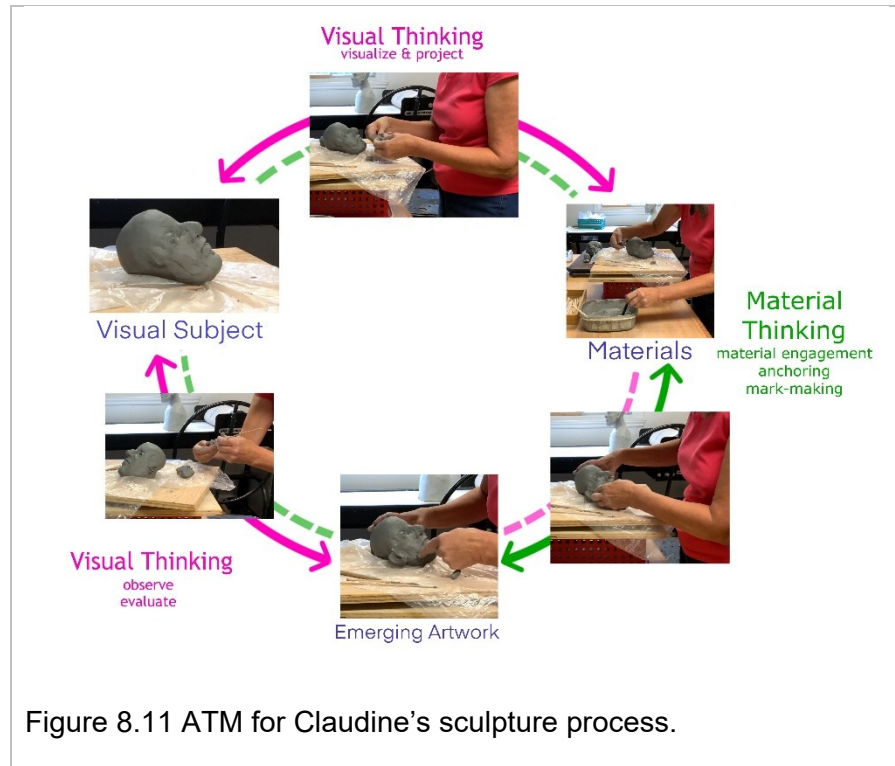


Figure 8.10. Claudine looks over the sculpture to gauge the placement of the ears

Visual thinking uses top-down and bottom-up reasoning.

The situated experience of being in the studio, working with clay, and choosing to do a portrait are all cues that will activate the perceptual motor systems that are related to her knowledge of sculpting. This is top-down knowledge that will guide her sculpting process. Bottom-up reasoning is activated through her engagement with the clay. Throughout the material process, she continually observes the emerging artwork, modelling the pieces of clay and adjusting them to work with the proportions of the head such as the length of the chin and the volume of the cheeks. The sculpting process is an ongoing dialogue between her established knowledge of human portrait structure and the specific clay sculpture that she is working on.



Characteristics of visual thinking.

In the artmaking process, visual thinking contributes to how the artist perceives, selects, and organizes information to transform and communicate it using visual/spatial structures. Perception is an active, goal-directed process where the artist seeks information to accomplish a task. It is also a skilled process. Knowing what information to seek and select, as well as what to ignore is a skillful process. In the perception-action cycle of embodied cognition, there is dynamic feedback between what is observed, how it is conceptualised, how it is projected and anchored through the materials, and then how this process is evaluated before the next search for information is undertaken. This process sets up an ongoing dialogue with the elements of the artmaking system, between the artist, the subject, the materials and the emerging artwork. The following is a summary of the concepts of the visual thinking process:

- The artist uses visual information available in the artmaking subject to scaffold and develop the visual/spatial construction of the artwork. Visual thinking is used to construct a chosen level of visual correspondence between the artmaking subject and the emerging artwork.
- Visual thinking uses analogical reasoning to map information from one domain of experience onto another. Analogical reasoning establishes a visual and conceptual

correspondence between the observed world and the visual/spatial structures that are constructed in the artwork. Visual depiction is a selective transformation of visual information.

- Visual thinking uses top-down and bottom-up reasoning. Specialized domain knowledge is used to guide and inform what is actively perceived in the elements of the artmaking system. This includes visual thinking processes such as focused attention, visual analysis, schematization, abstraction, synthesis.
- Observation, visualization and projection connects visual thinking to material thinking as part of the action/perception processes of artmaking.

The final section of this chapter will apply the concepts of visual thinking to the case study with Mary.

Visual Thinking: Case study with Mary

Mary's artmaking system is comprised of oil paint and the accompanying tools and accessories related to the material. She uses a selection of digital photos that she observes on her computer, and compositional studies in watercolour to assist in the visual construction of her artwork. The emerging artwork is a large 36 x 36-inch oil painting that depicts multiple figures. Mary's concept of art includes the knowledge and experience to create realistic figurative paintings and portraits in paint, and her interest in pop culture.

Using Visual information to develop visual/spatial structure

Mary's painting demonstration was the late stage of a large figurative painting that depicts several figures in an ambiguous night landscape. The figures are adolescents who have discovered an unknown glowing substance. The composition is framed by two large figures on either edge of the canvas. Mary uses a series of photos of different family members as visual resources for the figures. She also created several studies in watercolour to explore different possible compositional organizations. In the creation of this painting, Mary blends direct observation with imagination to create a complex composition. The colour scheme that she has devised is from imagination, whereas the poses and portraits of the figures are informed by the different photos that she observes on her computer as she works on the painting.

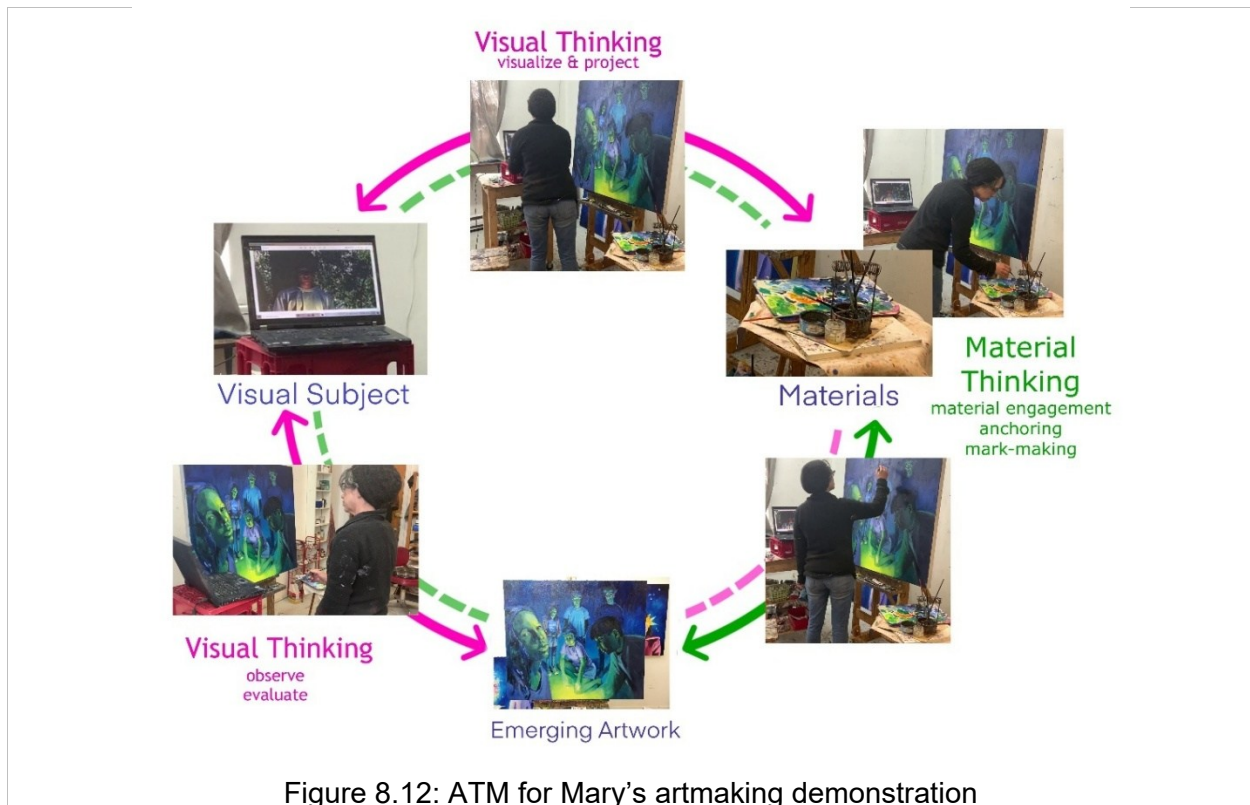


Figure 8.12: ATM for Mary's artmaking demonstration

Action/perception processes: Observation, visualization and projection.

The action-perception sequence that Mary uses during the demonstration consisted of the following: observation of photo resource, mix and pick-up paint, observe painting, observe photo, apply paint. After several cycles of this routine, she would step back and assess the overall changes to the painting and then repeat a similar cycle. Her action-perception sequence, interpreted through the ATM, is illustrated in figure 8.12.

Visual thinking: Visualize and Project.

Beginning with her interaction with the subject, the still-frame photos from the video of her demonstration illustrate how Mary observes the visual resources on her computer to selectively search for information about the facial features of the figure. This information is projected onto the palette as she mixes and chooses colour which is illustrated in the two adjacent photos showing her palette and her interaction with it.

Material thinking: material engagement, anchoring & mark-making.

Mary picks up a specific colour of paint with her brush and then gently scrubs it onto the painting surface. This is illustrated in the adjacent photo showing her embodied interactions with the painting.

Visual thinking: observe & assess.

After several cycles of this routine, she would step back and assess the overall changes to the painting and then continue to the next cycle.

Visual thinking: analogical reasoning to map information.

Whereas Michael's painting demonstration illustrated how he mapped information from the still life subject into the simplified shapes of the painting, Mary's demonstration illustrates how she selectively focuses on certain aspects of visual information in the photos and excludes what is not relevant to the goals of the artwork. For example, the group of figures in the painting was composed by selecting information from the various photos that she observed, such as the poses, the facial expressions and to a certain extent their clothing. She did not have one photo that depicted the composition, rather she constructed it by using multiple photo references. She selectively mapped information from the photos to the painting. The visual/spatial structure of the composition went beyond what was available to direct perception. The emergent painting is shown in figure 8.13

The circular organization of the composition moves from centre to periphery. Visual attention is drawn to the glowing focal point, while the figures radiate away from it. This is further reinforced by the light shadow structure. Notice that as we move away from the mysterious light in the lower centre, the composition gets darker. The figures are simplified in so far as she did not aim for anatomical perfection. She played with relative proportions for dramatic effect. The two figures in the front of the picture plane are much larger than the other ones. This draws attention to their expressions. Although the light and shadow structures that were available in the photos informed the tonal structure of the figures, she devised colour schemes from her imagination.

Visual thinking uses top-down and bottom-up reasoning.

Mary's painting demonstrates a masterful synthesis of top-down and bottom-up reasoning through her use of observation, selective processing and synthesis of the visual information that

she has gathered. Her process exemplifies what Fauconnier and Turner (2008) describe as conceptual blending: elements from different mental spaces are selectively projected into a new, emergent structure. Mary's painting illustrates how she was able to integrate the ideas of adolescents, a night composition, mystery, creepy colours and adventure into a single composition, thereby combining analogies and metaphors to generate a novel visual form. (Turner, 2006)

The visual thinking processes that are visible in her work include attribute differentiation which is illustrated by her ability to separate tone and colour. She selectively focused her attention on the light and shadow structures of the portraits that she observed in the photos but not the colours. This illustrates tuned attention which is the ability to filter out irrelevant information (Goldstone & Byrge, 2015). She was also able to recalibrate the proportions of the figures from the different photos, then unify and synthesize them into the group of figures in the painting.



Figure 8.13. Mary's emergent painting

Summary: Visual thinking and the ATM

Visual thinking has a unique and prominent place in the artistic process because artists both think and communicate using visual/spatial structure. Just as reading and writing are learned, so too is the ability to communicate through visual/spatial structure (Connolly, 2019). This chapter on visual thinking has addressed the complex nature of visual thinking in the artmaking processes of the participants to understand how it is grounded in the sensorimotor interactions of the artist and the components of the artmaking system. I have also emphasized that visual thinking in the artistic process occurs through different forms of visual content: direct observation, multiple visual resources, or relying on memory and imagination. Although each type of visual subject matter offers different ways of analyzing visual thinking, there are nonetheless common factors to look for. In brief, visual thinking is an embodied reasoning process that enables artists to perceive, select, organize, and communicate complex visual/spatial structures.

- The artist uses visual information available in the artmaking subject to scaffold and develop the visual/spatial construction of the artwork.
- Visual thinking uses analogical reasoning to map information from one domain of experience onto another.
- Visual thinking uses top-down and bottom-up reasoning that includes focused attention, visual analysis, schematization, abstraction, synthesis.
- Observation, visualization and projection connect visual thinking to material thinking as part of the action/perception processes of artmaking.

The next chapter examines the role of material thinking in the artmaking system and elaborate on its reciprocal relationship to visual thinking.

Chapter 9: Research Findings Material Thinking

Introduction

Material thinking and embodied cognition share a fundamental understanding of knowledge as emergent through action, perception, and material engagement. Both frameworks reject the classical model of cognition as the internal manipulation of abstract symbols, viewing thought instead as a dynamic, situated process unfolding through bodily interaction with the world. Material thinking, as theorized by Carter (2004) and Bolt (2004), emphasizes that ideas and meanings arise in and through the artist's physical engagement with materials, where resistance, affordance, and unpredictability actively shape creative inquiry.

Building on this, anthropologist Tim Ingold (2013) offers a strong critique of hylomorphic thinking. Hylomorphism, a concept derived from Aristotle, refers to the theory of a causal relationship between form and matter. In its contemporary usage, the hylomorphic model reduces the relationship between form and matter to the workings of the mind conceived as brain (Ingold, 2013). Cognitive theories of creativity often reinforce these beliefs, promoting the idea that "creativity starts with a mental idea subsequently imposed upon a material" (Malinin, 2019, p. 7). In this view, the mind determines the form, and the hands merely execute it, while material and bodily engagement play no active role in the thinking process. In contrast, Ingold (2013) proposes a principle of correspondence, where making is a process of following and responding to the vitality of materials. Materials are not passive carriers of form but active participants in thought and becoming.

This perspective resonates with *hylonoetic* thinking, a concept proposed by Malafouris (2013), which combines the Greek terms *hylo* (matter) and *noetic* (mind) to refer to the active role materials play in cognition. Hylonoetic thinking replaces the hylomorphic model by recognizing that material engagement is not secondary to thought, but constitutive of it. Whereas traditional views treat materials as passive elements bearing cultural significance, hylonoetic thinking foregrounds the active contribution of materials to the goals and outcomes of cognitive processes.

Material Engagement Theory (MET) offers a cognitive framework that further elaborates the role of materiality in thinking processes. MET positions materials as active components in the cognitive system, blurring the boundaries between thinking, making, and material responsiveness. It draws on both extended and enactive theories of cognition to analyze the

role of the body in material engagement. Extended cognition provides a model for understanding how materials and skilled actions are integrated into cognitive processes, while enactive cognition focuses on how embodied interactions with materials lead to sense-making and meaning construction.

In the theory of extended cognition, the artist's thinking process is structurally coupled with materials, understood as cognitive artefacts; external elements that are integral to cognitive activity. A two-way flow of information is established between the artist and the cognitive artefact: the artist transforms the materials, and the emerging material transformations, in turn, shape further thought and action. Thinking is thus conceived as reciprocal causal reasoning.

MET uses enactive cognition to refer to how embodied interactions lead to sense-making and meaning-construction. Malafouris uses the concept of enactive signification to describe how meaning is grounded in the material transformations of the artmaking process. Unlike linguistic symbols, material meaning is neither arbitrary, nor is it predetermined. The artist makes sense of the material affordances through the action perception cycles of enactive cognition. Meaning emerges through the material transformations that result in the creation of the artefact. Through action-perception cycles, artists engage affordances, responding to material transformations in ways that instantiate meaning through the making process. This chapter explores material thinking through the lens of hylonoetic thinking and Material Engagement Theory (MET), analyzing artmaking processes through the frameworks of extended and enactive cognition.

The fundamental affordances of the materials:

This section will re-examine the structure of material thinking that was proposed in the initial Artistic Thinking Model through the concepts of affordances and causal features. The concept of affordances developed by J.J. Gibson are the opportunities for action that the environment makes available to an organism. On the one hand affordances have objective characteristics that support and enable action (Gibson, 2015/1979; Gibson & Pick, 2000), and on the other hand affordances are relative to an individual's ability to perceive and use them (Chemero, 2009). The affordances of the materials in artistic practice are situated and supported by our sociocultural practices. Material "affordances are not relative to the abilities of a particular individual who actually perceives or detects the affordance. They have an existence that is relative to the skills available in the practice" (Rietveld & Kiverstein 2014, p. 337). One way to understand material affordances is through their causal features (Rietveld & Kiverstein 2014) and how they support the actions of the artmaking process. I will call these the

fundamental affordances that are intrinsic to the artmaking process. They include material properties, material methods, tools and techniques, and mark-making.

Material properties:

Understanding the affordances of a material includes knowing how physical properties support and enable action (Gibson & Pick, 2000). Every material has objective physical and chemical properties that lead to a variety of potential methods, tools and techniques that will accompany them. For example, oil paint is made of pigment and an organic drying oil such as linseed, walnut or poppy oil. These oils dry to a hard permanent film through oxidation. Once dry, the paint cannot be reactivated or brought back to its original state. Oil paint is prized for its versatility and its permanence. Understanding material properties is fundamental to the correct use of a material and to avoid problematic outcomes. For example, to avoid the cracking of a painting surface, understanding the drying time for different oil painting pigments is of great relevance to an oil painter who paints with thick layers of paint. Likewise, an awareness of colour permanence is also important if an artist does not want colours to fade.

Material Methods

Material methods refer to the strategies used by an artist to achieve specific goals of the artmaking process. For example, additive or subtractive methods refers to whether material is progressively added or removed. The choice of method often depends on the material's affordances. Whereas some materials afford both methods, others are more suited to one. For example, drawing with the ephemeral properties of charcoal and pastel facilitates adding and lifting the material, whereas the waxy nature of coloured pencil is more suited to the progressive addition of multiple layers of colour. In oil painting one can use a direct or an indirect painting method, where direct painting ('wet on wet', or 'alla prima'), refers to the application of colour while the paint has not begun to dry, and indirect painting refers to the application of wet paint over successive layers that are dry.

Techniques and tools

Whereas methods refer to broader strategic approaches to material engagement, techniques describe the specific embodied actions and tools employed to realize these strategies. For example, glazing with oil paint is a slow process that demands planning, an understanding of painting mediums and is often done with soft fibre brushes, such as sable. Direct painting on the other hand is more spontaneous. The ability to paint wet on wet calls for a

different understanding of how wet colours interactively mix and blend together. Whereas glazing tends to subsume the marks and gestures of the painter, wet on wet painting allows for the visible traces of the painter's hand.

Embodied interactions, gestures and marks.

Beyond methods and techniques, the most fundamental form of material engagement is mark-making itself, where thinking and acting converge directly on the material surface. Affordances as opportunities for action establish a reciprocal relationship between the artist and the fundamental material affordances (properties, methods, tools and techniques). The body is integral to the realization of material affordances, from simple habitual actions such as, how to hold a brush or organize a palette. Embodied gestures play an important role in realising certain methods and techniques. For example, the distance of the body from the canvas will constrain or afford different movements of the arm when applying a brushstroke; or drawing a line.

Mark making.

While material properties, methods, and techniques structure how artists engage with materials, it is through the direct act of mark-making that thought becomes materially instantiated. In Material Engagement Theory, mark-making is not merely an execution of prior ideas but a dynamic site where sense-making emerges. Malafouris (2013, 2021) describes mark-making as thinking in action. Mark-making is an enactive process of sense-making that is realized through the reciprocal relationship of artist-material affordances. In the process of making an artwork, marks accumulate to progressively construct the artwork, which will have some type of meaning, or will become a sign. The meaning is not instantaneous; it emerges through the transformation of the materials. The contrasting view from classical cognition is that an idea is reflected upon and then externalized. Whereas in language the word and its meaning are predetermined, when making something with materials, meanings emerge through the process of making. Meaning is concretely manifested through the material process.

Malafouris (2013, 2021) uses the concept of an epistemic action, originally devised by Kirsh & Maglio (1994) to further describe mark-making. An epistemic action is an action that alters the world and leads to new ways of thinking. When the artist observes the mark that is made, he is advancing what and how to think about the subject. This leads to the next cycle of visual-material thinking and enables the artist to discover new situational affordances and

reflects the notion of reciprocal causation or the circular causality that is established between the artist and the materials.

In summary, methods are embodied strategies for engaging with materials, and they are shaped by the affordances of each material. Techniques account for the physical enactment of methods. They are grounded in the artist's experience and in the affordances and constraints of a material. Mark-making refers to the embodied gestures of the artist with the materials to construct the emerging artwork. Both method and technique are co-determined by the dynamic interplay between the mind-body and the situated material environment.

The following sections will examine material thinking and embodied cognition through the participants' artmaking demonstrations. The objective is to:

- Demonstrate the connection between visual and material thinking in the perception/action cycles of the artmaking process.
- Illustrate the role of the fundamental affordances of the materials in the artmaking process.
- Examine material thinking through extended and enactive cognition.

Case Study with Michael: Material affordances & mark-making

This section will study Michael's artmaking process, from the perspective of material thinking and the fundamental affordances of materials to illustrate how they are integrated into the perception-action thinking processes of the artist. Before beginning the painting process, Michael draws the still life subject with a graphite pencil, using a semi-blind contour method, and a continuous line technique.

Material properties

As a material, the graphite pencil has certain affordances such as the fine tip, and a range of grey tones. The pencil affords the creation of a large variety of linear marks. The tonal range can vary based on the grade of lead and on the physical pressure that the artist uses. Unlike charcoal, graphite is difficult to remove from the surface of the canvas. This is an affordance or a constraint depending on the desired outcome. In this situation, the pencil supports the method and technique that Michael is using and supports his future actions. For example, the light grey tone of the graphite will not interfere with the painting process that Michael will use. The

pencil also affords a fine line drawing and continuous application without having to stop to replenish the material (as would be the case if the initial drawing were to be created with paint).

Material method: Semi-blind gesture drawing

A gesture drawing is a relatively quick and seemingly spontaneous drawing process that results in a contoured line drawing. It represents both the linear form of the compositional elements and the trajectory of the line as the artist and material move across the drawing surface. As a drawing method, Michael's visual attention is focused on the edges of the shapes of the composition with the objective of capturing them as a unified whole.

When using a continuous line technique, Michael does not lift the pencil from the drawing. As he observes the subject, he simultaneously moves his hand and pencil, circling around the canvas to create a continuous unbroken line. While executing the drawing, Michael's visual attention is on the still life subject and not on the drawing (Figure 9.1). He glances briefly and quickly at the drawing so as not to break his focus. Combining the semi-blind contour method with the continuous line technique is a means of concentrating on the visual structure of the artmaking subject.

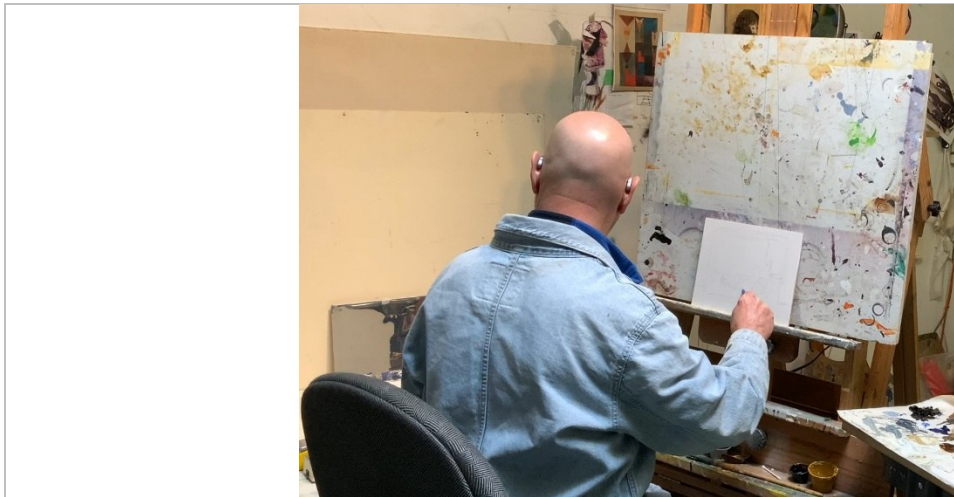


Figure 9.1 Michael doing a blind contour drawing

Drawing & Extended cognition:

Classical cognition would have us believe that this is a planned process. Michael observes the still life subject, his mind constructs a mental representation, then action follows. Extended cognition however offers a more pragmatic method to understand this process. The

hand + pencil are unified with the brain throughout the thinking process. Michael's thinking occurs through his action. Perception and action are not mediated by thinking. Thinking is the dynamic interplay of the brain, sensorimotor system and the pencil.

As he observes he draws; his thinking happens through the actions of drawing. The pencil is a cognitive artefact that is integrated into Michael's thinking process while he is drawing. The action-perception cycle of observing the still life and moving his arm-hand-pencil reflects reciprocal causation. His ability to perceive the pertinent elements of the still life, and his ability to create a continuous line drawing support his actions with the pencil. The affordances of the pencil determine the nature and outcome of the process which is a fine line drawing. Each element in the system has a causal effect on the other element in the system and supports the ongoing action. (Vernon et al, 2015.)

The pencil is both a material and a cognitive extension that Michael is in direct contact with. The movement of his arm is directly traced through the tip of the pencil. What he perceives through visual thinking extends down through the pencil during the action of drawing. He isn't thinking about the pencil or how to use it, rather he is thinking about the information he is perceiving in the still life subject. The speed and seemingly effortless nature of his actions reflect procedural and informational transparency (Heersmink, 2015). Michael's seamless drawing process reflects both procedural transparency, in his effortless coordination of hand, eye, and pencil, and informational transparency, in his rapid interpretation of the still life subject.

Phenomenal or procedural transparency refers to the ease with which someone uses a cognitive artefact. For example, when a tool is employed without difficulty or conscious effort, awareness of it recedes to the background such that the user is not aware of using it. This is also a characteristic of tacit knowledge (Polanyi, 1966; Heersmink, 2015; Andrada, 2020). Informational transparency refers to the ability to understand and interpret information effortlessly. In this example, Michael does not hesitate while he is drawing the still life. He perceives and interprets the visual information that is available in the still life subject with speed and efficiency. Procedural and informational transparency are aspects of extended cognition that reflect expertise (Heersmink, 2015). Having taught gesture drawing to my fair share of novice students, they do not enact this level of fluency with either the material or the subject. Their gesture drawings are rigid and halting because they are struggling to understand what they are seeing, how to hold the pencil, and how to draw using their arm rather than their wrists.

In other words, procedural and informational transparency is something that someone learns through prolonged practice-based experience.

Action-perception cycles for material and visual thinking.

This section will discuss the relationship between material thinking and visual thinking as a reciprocal and complementary action-perception cycle. This discussion focuses Michael's on oil painting process.

Oil painting: Foundational material affordances:

Michael is using a direct painting method with oil paint, where wet paint is progressively added to the canvas. He is using an impasto technique that takes advantage of the density of oil paint, which is one of the affordances of oil paint. Michael's technique is analogous to the concept of one stroke painting that is used in watercolour: once the mark is laid down, it is left alone.

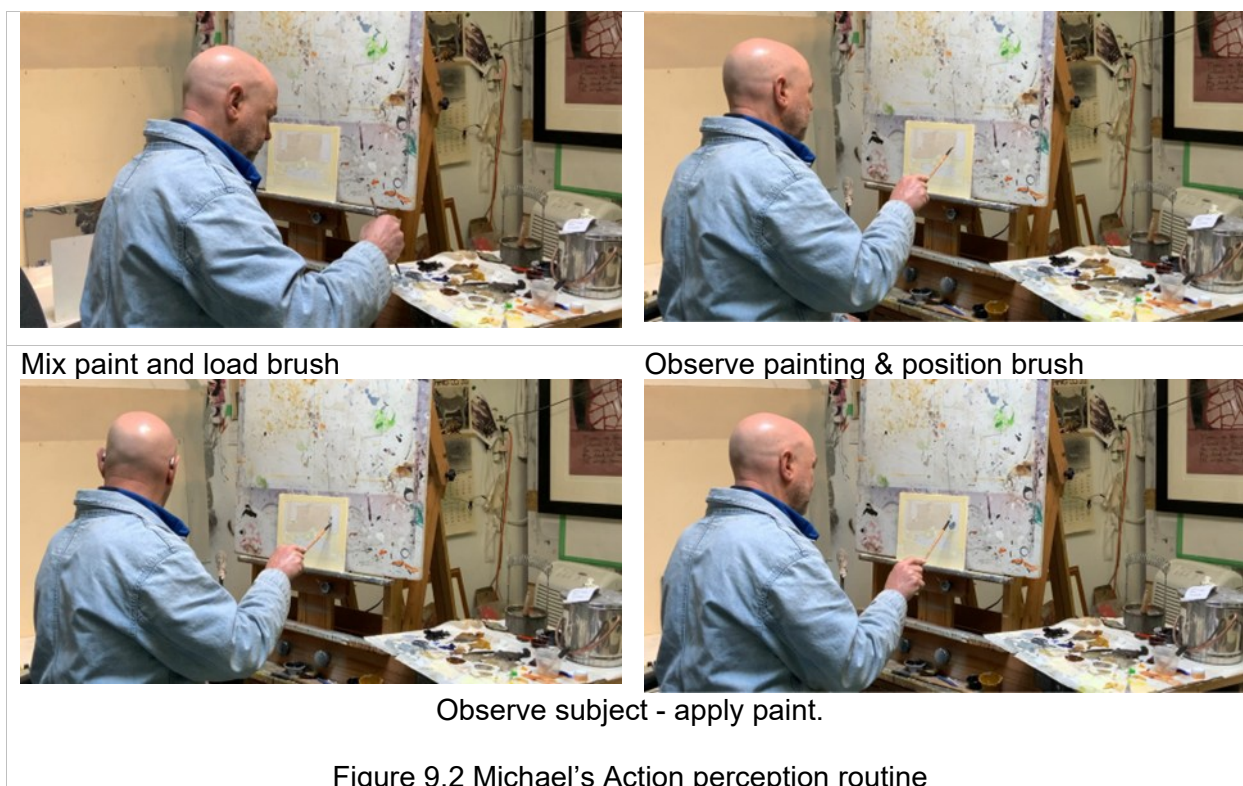
Michael: So if there is a mark here, I tried to make the brushstroke direct. Yeah, create that. Whatever it is.

Branka Marinkovic: So the brushstroke both creates the shape the color and everything all in one.

Michael: Yeah, so it's hopefully it is. by doing that I think it combines those things into one action. But that's when it works, or doesn't work. I think when those things don't cohere. You know, like it can seem like brushstrokes are things that are meaningless... I tell that a lot to people, when I'm teaching. Kind of like, you're not paying attention". (Michael, Post-demonstration interview)

Recall from the section on visual thinking that Michael uses the following action-perception routine:

- Observe subject - mix paint and load brush.
- observe painting and position brush.
- observe subject - apply paint.



Observe subject: He observes some aspect of the still life subject that is relevant to the particular stage of the painting process; this establishes the connection between the emerging artwork and the artmaking subject.

Mix paint and load brush: (Figure 9.2) He mixes the paint and loads the brush, establishing a connection between the still life subject, the emerging artwork and the materials. Mixing colour is part of projecting what he observes and visualizes in the still life onto the materials. This aspect of material thinking reflects his knowledge of colour as hue, tone and saturation, all of which come into play when choosing and mixing a colour.

Observe painting- position brush: Micheal looks at the painting and positions his brush on the canvas to prepare for the placement of the paint.

Observe subject - apply paint: Micheal looks back at the still life subject to connect what he was observing when he mixed the paint. When he applies the paint, the mark that he makes anchors the projected visualization onto the canvas.

When Michael loads the brush with paint and then carves out a shape with a broad decisive brushstroke, his visual thinking is aligned with his material thinking. He observes the

background of the still life subject and then visualizes part of it as a shape consisting of a colour and tone that he then projects and anchors onto the canvas as a field of colour. Using a bristle brush, heavily laden with paint, his arm and brush complete a gesture that deposits the paint on the canvas.

I would like to stop and reflect on how easy it is to read the phrase: 'background of the still life', versus the complexity of embodied thinking that went into creating it through the materials. What began as a blob of colour squeezed onto the palette from a tube of paint is mixed with other blobs of paint. It is then transformed into the visual spatial representation of one small portion of the background space of the painting. There is nothing in that initial blob of paint, nor in the mixed colour on the palette that equates to "background of the still life painting". The background of the painting that is given through the marks of paint attain meaning only through the embodied and concrete actions that were described above. This reflects the embodied and enactive nature of meaning construction that Malafouris refers through in the concept of the enactive sign in material engagement theory.

Material Thinking & Visual thinking In the ATM.

Within the artmaking system, the subject affords visual thinking, and the materials afford material transformations as mark-making. There is a complementary relationship between what Michael observes and visualizes relative to the artmaking subject, and the material transformations. Material transformations are a product of visual thinking, but visual thinking is guided by material thinking. When using the continuous line drawing technique with the pencil, Michaels' visual thinking focuses on the linear shapes and edges of the still life subject. When he is engaged in the painting process, his visual thinking is attuned to the shapes, colours and tones of each individual compositional element in the still life subject. When observing the still life subject, the information that he is searching for is directly related to the material process that he is using.

His action-perception routine reflects the complementary connections between the still life, the material, and the artwork. When Michael observes the still life, he visualizes a shape; when he engages with the materials, he projects what he has observed onto the paint and then anchors it on the canvas. He then looks at the canvas and then back at the still life. In this way, the actions of material thinking establish ongoing feedback between the elements of the artmaking system. Each mark that is anchored onto the canvas is a means of making sense of

the relationship between the artmaking subject and the materials and reflects the complementary relationship between visual thinking and material thinking.

Core principles of material thinking:

The case study with Michael illustrates some core principles of material thinking through embodied cognition and material engagement theory.

- Material thinking contributes to the visible, physical and spatial structure of the emerging artwork.
- Materials have foundational affordances that are crucial to learning how to think through materials. These are material properties, methods, tools, techniques, and mark-making.
- Material thinking and visual thinking establish a reciprocal and complementary relationship that corresponds to the action-perception cycles of embodied cognition.
- In embodied cognition, the artist's thinking process is structurally coupled with the materials. Material transformation occurs through the relative affordances of artist + material. These affordances are realized through the embodied actions of the artist.
- Within the artmaking system, material thinking is how the artist projects and anchors material transformations on the emerging artwork. It is how the artist makes sense of the artmaking subject through material transformations.
- Material transformations are epistemic actions that create ongoing feedback between the elements of the system. This means that material transformations enable the artist to advance how and what they think about the work as it evolves.
- The meaning of the artwork is progressively constructed through the ongoing interaction of the artmaking subject, the artist, the materials and the emerging artwork.

The following section examines these core principles through the case study with Claudine.

Material Thinking: Case Study Claudine

The case study with Claudine presents the opportunity to study material thinking through the process of sculpting with clay. This section will begin with an overview of the fundamental affordances of clay as described by Claudine, followed by an examination of her process through extended and enactive cognition.

Claudine offers a description of the material properties of the clay:

“Clay will go from being a sculptable dough, which you can work with, to a hard leather where much of the water has evaporated but can still be worked with tools to refine the surface. You can pull material away but you cannot add any more to it. So as a dough it is additive and at the leather stage it is reductive. At the bone dry stage it can still be reductively worked on, but it is much more fragile.”

She also describes the tools and some aspects of the methods that she uses:

“My fingers are the essential tools, if I need to refine, I have a set of tools for this kind of work and material, which is a firable clay, which has to be put in a kiln, a ceramic oven, for it to become solid, petrified, for it to become permanent. So, water, wooden tools, sponges to clean the surface with, a slip that I use as a glue if I have to add and join elements, but those come in the secondary stage. In the first stage I usually come in with the hand modelling of the material.”

Claudine's method is mostly additive, meaning that clay is progressively added to the sculpture to construct the features of the portrait. She will occasionally remove small amounts of clay to refine certain shapes and features. As she mentioned, she is using clay that is a soft dough which affords the addition of shapes that are glued to the surface using the slip, and gestures such as pushing and smoothing the clay. Claudine uses the following techniques throughout the sculpting process:

- **Rolling the clay:** Pieces of clay are rolled or squeezed into the palms of the hand. This action warms the clay, making it more malleable.
- **Modelling:** The clay is modelled into small shapes that are added onto the sculpture.
- **Score & Slip:** The pieces of clay are scored with a sharp wooden tool and slip is added to the surface to facilitate the adhesion of clay pieces.
- **Pushing:** Using fingers and thumbs, the clay is pushed in specific directions to articulate structural shapes. Smaller shapes of clay are integrated into the mass shape of the head by pushing and smoothing the clay.
- **Incisions:** Fine wooden tools are used to draw onto the surface of the sculpture.

Action/perception process

As discussed in the previous chapter, Claudine uses the following action perception cycle:

- Observe artwork,
- Visualize portrait feature,
- Shape clay into three-dimensional form to represent a facial feature,
- Integrate clay into artwork,
- Observe and assess artwork for next stage.

The still frame photos in figure 9.3 represent the construction of the chin during the sculpting process. They will be used to discuss Claudine's material thinking process. While observing the sculpture, Claudine determines that the lower part of the jaw should be extended further into space. She takes a piece of clay and rolls it in her hand to create a shape. This action illustrates that she is actively thinking about the facial structure through the clay. The size of the piece of clay that she is modelling illustrates that she is projecting what she is visualizing. Projection and material transformation are tightly connected as the chin begins to take shape through the piece of clay. She scores the surface, adds the slip and then anchors the clay into the mass of the skull. She then pushes and smooths the clay, solidly integrating it to the sculpture. She achieves anchoring and mark-making through her embodied actions with the materials.



Figure 9.3 Claudine: Construction of chin

Clay transformations and extended cognition

In extended cognition, clay is a cognitive artefact that is structurally coupled with Claudine, and it is constituted in the action-perception cycles of her thinking processes. (Kirsh, 2013, Clark, 2016) As Claudine works with the clay, each action of modelling a piece of clay into a simple shape and then integrating it into the portrait moves the work forward, creating new information regarding the evolution of the work. These embodied mark-making actions are epistemic actions, and they establish feedback mechanisms that enable her to assess her progress and determine which actions to do next. (Kirsh, 2013; Malafouris, 2013, 2021).

There is a two-way flow of information that is established between the artist and the clay as a cognitive artefact (Heersmink, 2015). Claudine transforms the materials and the material transformations in the form of the perceivable shape of clay enables her to further think and act with the materials. The ease with which Claudine works with the clay demonstrates how it is integrated into her thinking process. The smooth workflow, and the masterful integration of the fundamental affordances of material thinking illustrates procedural transparency. In other words, Claudine is not focusing her attention on what types of techniques are needed to model the clay, rather she is focusing on the clay as it becomes the portrait in three-dimensional space. Claudine does not falter because she knows how to construct the portrait; what a nostril, brow, or ear should look like. The ease with which she responds to the material and the emerging portrait sculpture illustrates interpretive transparency (Heersmink, 2015).

Clay as an Enactive sign.

The concept of the enactive sign views material engagement as a process that is unmediated by language. Meaning is generated through the embodied interactions of the artist and the material such that thinking is integrated in the ongoing experiential encounters. (Malafouris, 2013; March & Malafouris, 2023).

Each interaction of Claudine's hands, as she rolls, squeezes, pushes, and pulls the clay, gradually transforms the soft pieces of dough into organic shapes. The integration of the small, modelled forms of clay onto the mass shape of the head are actions of sense-making. The gradual transformation of pieces of clay to become the upper lip, the lower chin, the ear or the furrowed brow gives them a new meaning, and this meaning emerges as the face takes form. Towards the end of the demonstration, Claudine spontaneously decided to add a hand to the

composition because she thought that the face expressed someone deep in thought. She felt the hand would enhance that expression and augment the meaning of the work.

Top-down and Bottom-up reasoning in Material thinking

Top-down reasoning refers to cognitive processes that draw on prior knowledge, goals, and conceptual frameworks. Within the framework of embodied cognition, to understand is to simulate, to mentally re-enact experiences using the same neural systems involved in perception and action. This simulation is rooted in sensorimotor experience, implying that the brain areas used to interact with the world are also engaged in remembering and conceptualizing skills and knowledge (Lakoff, 2018; Matheson & Barsalou, 2018; Johnson & Tucker, 2021). Over time, situated experiential learning shapes long-term memory, establishing the neural networks and body schemas that underpin future simulations. Whether working from an external cue (such as a still life) or an internal concept (like a mental image of a face), the artist's skills depend on a network of sensorimotor schemas developed through repeated, embodied interactions with tools and materials (Barsalou, 2018; Baggs et al., 2020). These schemas are not merely technical; they are deeply cognitive, guiding perception, attention, and decision-making.

Michael's top-down knowledge of methods and techniques is comprised of embodied schemas that are activated through the situational cues of the still life subject, the pencil, and the canvas. His embodied schema enables him to seamlessly combine what he perceives with his actions. As elements in the artmaking system, the material + the visual subject + the method, which in the case of Michael is the pencil, the still life subject, and a contour drawing method, affords the visual attunement to the edges of the composition, and the rhythmic gestures of a line drawing.

When Michael shifts to painting, new material cues, paint, brushes, and palette, activate different schemas. Although the visual subject remains the same, his simulation system now attunes to colour, tone, and forms rather than linear shapes. This illustrates how bottom-up sensory input from the environment and top-down conceptual knowledge are continuously interacting. His perceptual focus shifts because of the material transformations, showing how the body's memory of skilled interactions guides the unfolding process (Malafouris & Koukouti, 2018).

Claudine's sculpture demonstration further illustrates this interplay. Claudine's concepts of portraiture, sculpture and clay will activate the embodied simulations and sensorimotor schemas needed to navigate through the process. Concepts such as 'chin', shape' and 'volume' are not abstract, they are embodied schemas that are developed through years of experience with sculpting. The material affordances of clay, its weight, texture, and resistance, are perceived and integrated through ongoing action-perception cycles. Her top-down understanding of human anatomy and sculpting methods is in constant dialogue with the possibilities offered by the material and the evolving sculpture.

Within an embodied cognition framework, top-down and bottom-up reasoning are not separate modes, but interdependent processes co-constituted through embodied artistic activity. In both cases, we see a reciprocal and structural relationship between visual thinking and material thinking. When Visual information is projected, materials are transformed and anchored onto the emerging artwork through mark-making. The artist's reasoning is enacted, not abstracted: it emerges from the real-time interaction of brain, body and material. In this embodied framework, top-down intentions are continuously modulated by sensorimotor feedback, while bottom-up discoveries can reshape conceptual expectations.

The artmaking system & material thinking

In the artmaking system, the artmaking subject provides the artist with affordances that promote visual thinking. Using visual thinking, the artist will observe or imagine and visualize information that is relative to the artmaking subject, the material process, and the emerging artwork. In this stage, visual thinking takes the lead, but it is also mediated by material thinking because what and how something is visualized is related to the materials and material methods. For example, contour drawing leads to visualizing a line, sculpting leads to visualizing a three-dimensional form. When the artist visualizes information, it is projected onto the material which actively connects visual thinking to material thinking.

Material thinking involves the foundational affordances of the materials and the artist's ability to implement them. The artist will project what is visualized onto the materials and then anchor the material on the emerging artwork through embodied gestures and mark-making. This transformation of the material leads to the transformation of the emerging artwork. In the illustration (Figure 9.4), the solid green line represents the focus on material thinking. The complementary and reciprocal relationship between visual and material thinking implies that visual thinking does not stop, hence visual thinking is represented by the broken red line.

When the artist looks at the emerging artwork and assesses it relative to the artmaking subject, the artist is observing and reflecting on both the visual and material structure of the work. This reinforces the feedback loop within the system.

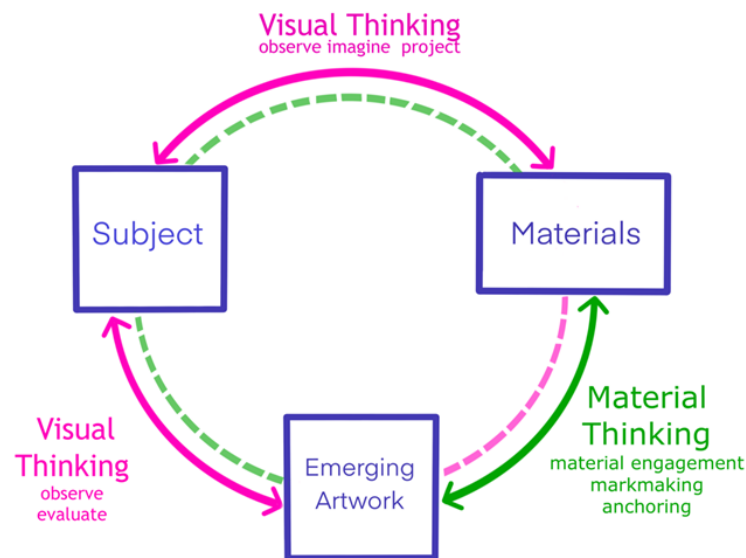


Figure 9.4 Integration of material thinking with the artmaking system

Material Thinking Summary:

This chapter studied material thinking through the artmaking demonstrations of the participants to understand how the materials are intrinsic to their thinking processes as they work to achieve the goals of the artmaking process. The concept of fundamental material affordances proposes that material properties, methods of interaction, techniques, tools, and mark-making are foundational to thinking and engaging with materials.

The materials are elements of the artmaking system, and they also generate modes of embodied thinking. Through extended cognition, the materials are structurally coupled with an artist's thinking processes to achieve the goals of the process. Recognizing that materials are constituted in the thinking processes, moves us beyond the hylomorphic view of mindless technique. Through theories such as simulation, technical skills are deeply embedded in embodied schemas and are connected to conceptual understandings that shape how to see and communicate what we think through visual and material structures. The materials play an agentive role in determining our actions (Malafouris, 2013). This is the causal connection that binds visual and material thinking together during the artmaking process.

When we view artmaking as a representational practice that is equivalent to linguistic signification, we are disregarding dynamic exchange between the body, mind and material. Representation does not precede creation, rather it is the emergent outcome of the interactions between artist, material, and world (Bolt, 2004; Malafouris, 2013). This perspective on material thinking and skills offers a means of reconceptualising how the mind and thinking are developed through material engagement (Malafouris, 2013). The next chapter will examine Qualitative thinking and how it can be integrated into the artmaking system.

Chapter 10. Research Findings: Qualitative Thinking

Introduction

While visual and material thinking can be observed through the choices and actions of the artist during the artmaking process, qualitative thinking plays a different role. Unlike visual and material thinking, which adjusts in response to the needs of the transforming artwork, qualitative thinking tends to remain consistent, serving as a stable background of embodied awareness and emotional orientation. It acts as a guiding frame of reference that underpins the artist's decisions, motivations, and interpretive choices across the artmaking process.

Qualitative thinking refers to the bodily felt dimensions of conscious experience, what it is like to feel, sense, and be situated in a particular moment of making (Nagel, 1974). This dimension of thought, while central to artistic inquiry, has historically been overlooked in cognitive science due to the dominance of computational models that reduced cognition to brain-based symbolic manipulations (Johnson, 2017; Käufer & Chemero, 2015). Phenomenologists, however, have long emphasized the centrality of lived experience, and recent developments in embodied cognition offer promising pathways to reconcile these perspectives (Varela et al, 1991/2016). Yet, articulating and studying qualitative thought remains methodologically complex.

Although a finished artwork can be observed and analyzed, such interpretations inevitably reflect the spectator's qualitative experience, which may diverge from that of the artist. My research seeks to examine the role of qualitative thinking in the artistic process itself: how it motivates inquiry, shapes intention, and informs the dynamic unfolding of meaning through embodied engagement. This section will explore these ideas through data gathered from the participating artists and supported by the theories of John Dewey and Antonio Damasio, both of whom offer crucial insights into how emotion and felt experience function as drivers of cognition (Johnson, 2017). Finally, this discussion will be situated within an enactive framework, emphasizing how sense-making and embodied action constitute the artmaking system.

John Dewey

When John Dewey (1998) originally published *Qualitative Thought* in 1930, he sought to challenge dominant philosophical assumptions about thought, the body, and emotion. At the

time, thinking was widely conceived as a disembodied, logical process, while artistic practices were often dismissed as affective and non-cognitive (Dewey 1998; Frisina, 2002; Johnson, 2017). In contrast, Dewey argued that artistic production involves complex, situated reasoning. As he put it:

“The underlying quality that defines the work, that circumscribes it externally and integrates it internally, controls the thinking of the artist; his logic is the logic of what I have called qualitative thinking.” (Dewey, 1998, p. 199)

Dewey’s concept of qualitative thinking underscores the central role of affective, felt experience in guiding thought and constructing meaning. He maintained that the immediate, pervasive quality of experience, what he called primary experience, forms the background, starting point, and guiding principle for all thought (Dewey, 1998; Frisina, 2002; Shusterman, 2005). This felt quality precedes cognition and becomes articulated through language and analysis in what Dewey termed secondary experience (Stankiewicz, 2011; Frisina, 2002; Johnson, 2017). Where analytical reasoning breaks experience into parts, qualitative thought is holistic: it binds together the various aspects of experience and its context. It is through felt experience that thinking becomes coherent, situated, and meaningful.

Dewey (1998) outlines several core features of qualitative thinking:

- It establishes coherence: The felt quality binds together different aspects of an experience into a unified whole.
- It situates thinking: What and how we think is shaped by the emotional and sensory context of the experience.
- It initiates inquiry: A felt quality can provoke reflection and guide the desire to understand.
- It frames relevance: The qualitative character of experience acts as a filter that guides what is selected or ignored in thought (Dewey, 1998; Shusterman, 2005; Pappas, 2022).

In Dewey’s view, felt experience is not opposed to thinking, it is its foundation. Qualitative thought offers a model of reasoning that begins in the body, in sensation, and in emotion, thereby expanding the boundaries of what counts as cognition.

Antonio Damasio

Contemporary neuroscience has revisited and expanded many of the ideas first introduced by Dewey under the framework of qualitative thought. Researchers like Antonio Damasio have explored how embodied emotions and affective processes shape consciousness, inquiry, and the construction of meaning, reaffirming Dewey's insight that felt experience forms the foundation of thought.

Damasio argues that consciousness emerges from the complex relationship between the body and the nervous system. Central to this view is the distinction he draws between emotions and feeling. Emotions, as Damasio (2010, 2018) explains, are bodily responses to internal or external stimuli. These emotive processes are largely unconscious and function to maintain homeostasis; examples include thirst, shivering, or a sneeze. They also include reflexive responses to sensory input, such as recoiling from a hot surface or grimacing at an intensely bitter taste.

Feelings, on the other hand, are the conscious mental interpretations of these emotional responses. While the emotional signal is involuntary, feelings involve cognitive awareness and meaning making. For instance, a rumbling stomach is an emotional cue, while the recognition of hunger is a feeling, an act of interpretation layered with consciousness. As Damasio and Damasio (2024) note, feelings are grounded in the body and represent the capacity for self-awareness, a bridge between subjective bodily states and the external world.

Much like Dewey, Damasio emphasizes that these embodied emotions and their cognitive counterparts are the starting point of reflection, decision-making, and creativity. Emotional experience motivates us to think, inquire, and act. It is through these affective and sensory interactions with our environment that we begin to construct values, beliefs, and social norms. These internal systems, shaped by both biology and culture, are embedded in all forms of reasoning and expression (Damasio, 2018; Barsalou, 2020).

Furthermore, feelings do not merely guide individual action; they also play a significant role in social and creative processes. Damasio (2018) contends that they motivate artistic and intellectual inquiry, allowing us to evaluate the success or failure of our actions, and help adapt and refine our practices over time. This dynamic understanding of affect as a driver of consciousness and culture aligns with Dewey's conception of qualitative thought as a felt, situated, and integrative mode of thinking.

The key takeaway from this discussion of qualitative thought is that emotions and feelings are central to motivating inquiry and problem-solving. The felt quality of experience not only initiates thought but also situates it, providing coherence and relevance. By shaping our frames of reference, affective experience makes thinking more meaningful and anchored in lived, embodied contexts.

Qualitative thinking: Participant case studies

Understanding the qualitative thinking of the artists consisted of analyzing their responses during the interviews and comparing them to their artmaking demonstrations. The questions focused on the following ideas:

1. Description of the subject matter.
2. Reasons for choosing the subject.
3. The meaning of the artwork.

The data analysis consisted of determining if and how the artist made connections between the elements of the artmaking system and the other modes of thinking of the ATM. Their responses show that motivation is a multifaceted interaction that binds personal experience and concepts of art to the subject.

Case study with Michael.

The demonstration that Michael created for the research was connected to a series of still life paintings that he had been working on during the pandemic. During the demonstration interviews, Michael described why he had chosen to examine this subject:

“Just this bunch of work, like this, I've never done still lives before in this way. So it's kind of new, like, I've always resisted it and it never interested me, but all of a sudden it does. And I think there's a kind of, it's what goes with what? That's interesting to me. So there's a, there's what goes with what in each individual painting, but then what painting follows that painting?...That's the problem. So, it's the next, like, what happens after this? I don't know” (Michael, post-demonstration interview).

The still life paintings that he created were a departure from the landscape paintings that he had been exploring in recent years. Although in the past, he would paint objects and interiors as he found them in everyday life, intentionally composing still life objects was a different

approach. Michael's concept of art centres on the perspective of the artist and his visual interpretation of the world around him. Throughout his career, Michael has oscillated between working from photos and working from direct observation. He never deviates from his passion for exploring visual structure:

"There's been a lot of jars with water. There's been a lot...of different things. I like the optical, the optical distortion" (Michael, post-demonstration interview)

Beyond the substance of the visual subject matter, Michael is constantly looking for ways to devise and confront novel painting problems.

"I don't want to feel like I'm just painting the same thing over again. I want it to be an adventure, like there's some discovery going on, or some kind of a narrative. Maybe I don't understand, but something is being worked through."
(Michael, post-demonstration interview)

Michael was reticent to ascribe a specific meaning to the still life paintings that he had created. Instead, he spoke about the relationship between the artmaking subject and the material.

"What a big part of it is how to make the paint meaningful to the image, how to combine those two things. It's continually a question to me...do I want to work really wet on wet or do I want to paint to be thick? Then, how thick, how much paint am I putting? Basically, how do I put those things together." (Michael, post-demonstration interview)

Michael has expressed a crucial challenge for many artists when making art, which is how the qualitative experience of the artmaking subject can be represented as visual and material form.

Case study with Claudine

Claudine's creative practice examines how different facets of identity can be expressed through figurative work. Blending imagination and observation, she constructs narratives that are inspired by her personal experiences and those of individuals that she interacts with. During the demonstration interviews Claudine speculated about creating a series of portraits that

represent artists through the styles that they use to create their art. At the beginning of the demonstration, she described the work she was about to create:

"The exploration here is to find a kind of face that I think I can work with.... Ultimately what I am looking to create are a series of faces, this is an example of one, and body parts, like hands feet, arms, legs...that I will assemble in a non-representational way. The fundamental forms will be based on realism, but what I ultimately do with them may be more abstract or surreal." (Claudine, pre-demonstration interview)

When asked if the portrait is supposed to represent a particular person, her response was:

"No it's a kind of introduction. I'm walking into the room which is this project, and I am introducing myself to the host, and in this case, the host is the clay. I haven't worked with this clay in this way before, so I am going to introduce myself to the clay, and its going to introduce itself to me, and we are going to have a preliminary conversation. Thats where I'm at right now, I am entering into this creative space with the intent of where I want to end up. Rather than come into it with my previous work, I have to adjust and recalibrate my brain, and the way to do that is with a dialogue with the materials." (Claudine, pre-demonstration interview)

As exploratory work, she was open to the accidental outcomes of the process and the different directions that her interaction with the material can take her.

"I don't see it as a problem to solve, but as an image to discover"

"If I have no actual intent of an emotion, but a particular stroke of my tool creates, where I was putting what I thought was a neutral mouth, for instance, the stroke of my tool creates a snarky or an angry mouth. I might look at that and go, Oh, you're angry. Okay. So that takes me somewhere new. And that can be very intriguing. That can be very challenging." (Claudine, post-demonstration interview)

At the end of the demonstration, when asked what she thought of the portrait that she created, Claudine felt that the portrait represented her state of mind.

"It's a moment of reflection. Okay, it's basically where I'm at. What's interesting with this project that I'm embarking on is I'm reflecting on it prior to engaging in the production of this series of works that I want to produce, so I think the piece is reflecting my attitude and my position in relation to this work I'm about to engage in." (Claudine, post-demonstration interview)

Claudine's demonstration is illustrative of the material-based exploration of potential ideas that artists engage in. Sketches are not an end point, rather they are created to generate ideas and facilitate reflection. (Tversky, 2014)

Case study with Genevieve:

At the outset of her demonstration, Genevieve arrived at the studio with several canvases, acrylic painting materials, charcoal and conté for drawing, and a couple of magazines. During the pre-demonstration interview, when I asked Genevieve to describe her artmaking subject, here are excerpts from her response:

"And I don't know...I've seen all these things this week that are super influencing me. I'm just thinking of something that's being pushed, squished up on this side.

And I've seen that Anthony Bourdain movie. Did you see it? It's just like a journey and how it ended up. He killed himself at the end... I'm really attracted to it; I understand his life. I totally understand his life but just the way it was filmed.

"I do have well, an intention, there are images in my head that I need to put down somewhere. I just ended up living with them for weeks and weeks" (Genevieve, pre-demonstration interview)

Although Genevieve did not have a clear idea about the visual structuring of the artmaking subject at the beginning of the demonstration, she indicated that she was framing the process through her experiences of recent events. This aligns with her concept of art which deals with physical and psychological struggles that she draws from the media. After the demonstration, she was able to articulate some of the ideas that were emerging from the process:

"it's like, physically, the body struggling, tensions in the body. And of course, it comes into the mind as well. So like mental health issues.

What is the struggle? I mean, again, it can stay vague. But for sure, it's about the body. And I think it's about the struggle, but I feel like I always think of hope. Then there's like darkness and hope, even if it's just like a bit of white light or something like that. " (Genevieve, post-demonstration interview)

She indicated how she visualized these ideas in her composition:

"The face, like this tension on the left? So yeah, that kind of surfaced right at the beginning, this kind of tension. So the push and pull, or like something being kind of pushed on one side was appearing in the beginning. But as I was working from the face to the hands, kind of a back and forth, the face was just too big."
(Genevieve, post-demonstration interview)

Genevieve's demonstration lasted for 90 minutes and although the painting was well under way, it was not finished, and she had yet to finalize her ideas about it.

The previous case studies illustrate that a clearly defined subject or well-articulated problem is not always the point of departure, Dewey explains this in the following way:

"[S]omething presents itself as problematic before there is recognition of what the problem is. The problem is had or experienced before it can be stated or set forth; but it is had as an immediate quality of the whole situation. The sense of something problematic, of something perplexing and to be resolved, marks the presence of something pervading all elements and considerations. Thought is the operation by which it is converted into pertinent and coherent terms." (Dewey, 1930/ 1998. P. 198).

According to Dewey, it is the qualitative nature of thinking that brings the different threads of experience together. Although the problems or goals of the process may not be readily apparent or easy to articulate, by engaging with the materials thinking happens, objectives come into focus and intentions begin to emerge.

Whereas Claudine and Michael had determined the visual subject matter before beginning the artmaking process, the work was not an end in itself, but rather a means of exploring and thinking through certain ideas. Genevieve on the other hand articulated certain feelings and used the process to determine how to express them. In the case of Claudine and Michael, their ideas and intentions came into focus by exploring the artmaking subject. In the case of

Geneviève, her emotional connection to an experience was the catalyst for the process that resulted in the development of the visual and material structure of the artmaking subject. This section illustrated that the artist's choice of subject matter for the artmaking process is connected to certain aspects of their personal experience whereas their concepts of art contribute to how they can connect their subject matter to their artmaking practices.

Qualitative thinking as sense-making

In enactive cognition, the brain-body-environment forms a dynamically coupled system. Cognition emerges through the coordinated interaction of the elements in the system (Gallagher, 2017; Colombetti, 2017, 2018). A dynamic system is a self-organising system that adapts to the environment, seeking equilibrium and regulating itself within its surroundings. This means that the outcomes of the system are a function of how the different elements interact to reach a goal (Varela et al, 1991/2016)

Initially, the elements of the artmaking process appear to be in a chaotic state. There is the artist, a notion of subject matter, and some materials in their raw state. As the artist interacts with the elements in the artmaking system, through choices, decisions and ongoing feedback, the goals of the process begin to emerge. (Ladyman & Wiesner, 2020)

Sense making is the ability to apprehend the available affordances and utilize them to satisfy the goals of the process. This includes appraisal and selection based upon what the artist considers to be relevant from the elements of the system. (Colombetti, 2017) In previous sections, the concept of affordances and sensemaking were used to describe the formal process of how the artist constructs the visual and material structure of the artwork. Affordances are not just the visual information or structural formal properties that the artist looks for when making the artwork. At the most basic level, noticing and grasping an affordance as a potential for action, begins with the needs and purposes of the individual and reflects what someone considers to be meaningful to their goals. (Reitvald, 2014; Colombetti, 2017). Johnson (1987) describes the relationship between sense-making and meaning making in the following way:

"[I]t is meaningful in a more mundane sense, namely, it involves an exceedingly complex interaction with your environment in which you experience significant patterns and employ structured processes that give rise to a coherent world of which you are able to make sense" (p. 31).

As illustrated in the interviews with Michael, Claudine and Genevieve, the artist is not indifferent to the chosen subject matter. As they described how and why their chosen subject related to personal experiences and their creative practice, they were explaining not only what motivated them to engage in the artmaking process, but why it is meaningful to them.

Reciprocal qualitative affordances in the artmaking system.

The elements of the artmaking system have qualitative affordances that come to light through the complex interactions of the artmaking system. A qualitative affordance can be said to give rise to qualitative thinking by providing context, by acting as a catalyst, by offering frames of reference, and by bringing coherence to how the elements interact to reach the goal of the system.

The artmaking subject represents an opportunity for the artist to engage in some form of inquiry or exploration, providing a context for the artmaking process that is embedded in a sociocultural environment. At the beginning of the artmaking process, the subject can be a concept, theme, and it can have some visual form. For example, Genevieve chose the topic of struggle and drew inspiration from the dramatic story of someone who committed suicide. This connected her artmaking process to broader societal concerns. Michael chose a still life as a visual subject, which has a long history in the field of the visual arts and establishes a connection between his work and other artists in the field.

The artist will have a connection to the artmaking subject based on their personal experiences. The interests, concerns, curiosity and values of the artist are qualitative affordances that are frames of reference for how an artist interacts with the subject. Genevieve is moved by the suffering of others and feels empathy for their plight. Searching for new challenges in his painting practice, while at the same time sheltering during the pandemic, Michael is experimenting with the visual distortions that arise from the juxtaposition of various objects.

As described in the section on material thinking, the materials have foundational affordances that include material properties, methods, tools, techniques and mark-making. Each artist has their own understanding of material affordances that grows out of their artistic practice and is part of their concept of art. The artist's concept of art will establish a connection between the materials and the subject matter. Material affordances are also embedded in various communities of practice and are part of the greater norms of artmaking. Materials have

qualitative affordances that are realised through sensorimotor and affective experience. Throughout the material process, these affordances function at the granular level through the specific appraisals, choices and actions. It is through visual and material thinking that the artist communicates the qualitative experience of the subject.

What is the artist making sense of?

Qualitative affordances are distributed across the artmaking system as potentials for the self-organizing nature of the process. The interests and concerns of the artist, the artmaking subject and the materials are all catalysts for the artmaking process. The qualitative experiences of the artist frame the process and establish cohesion. When the elements of the system interact, the reciprocal dance of affordances and sense-making begins (Colombetti, 2017). The artist, with the other elements of the artmaking system, works towards determining the goals for creating the artwork. As the artist makes sense of her qualitative experience of the subject matter through the qualitative affordances of the materials, the artwork and its meaning emerge and take shape. (Malafouris, 2013, 2018, 2021)

Qualitative affordances: Case study with Mary

The painting that Mary was working on for her artmaking demonstration is part of a series that she calls the Destroyers. Here is how she describes the series:

“And it's paintings of younger people, teenagers, kids. And I pose them in situations that are kind of evocative of pop culture, teen thrillers, Nancy Drew, all that stuff...It's those tropes and archetypes, stereotypes of girls and boys.... playing with older people's fears of kids and teenagers.... because, you know, we kind of project all our fears and hopes on the younger generation” (Mary, pre-demonstration interview).

The context for Mary's painting comes from her interest in exploring the fears and anxieties of adult parents when their adolescent children begin to venture out into the world. She ties these ideas to popular culture in film and television. On a more personal level, Mary is a parent of young adult children and she is part of a larger extended family with many nieces and nephews. Mary's artistic process begins with photos of family members that become cues and inspirations for her narrative compositions. She will create different studies in watercolour and oil paint to work through her ideas regarding colour and composition before she begins a larger scale oil painting.

“[A]s I was painting the watercolors, I started to see how they would work together and how there was almost a narrative of these kids who are exploring this world and going on different planets” (Mary, pre-demonstration interview).

These feelings were further explored using the colour palette that she devised for the painting. The choices and decisions that she made for the composition and colour palette were framed by the feelings that she wanted to elicit. Her visual and material thinking was mediated by the felt experience that she used to frame the process.

In Material Engagement theory, the concept of the enactive sign examines the semiotic nature of materials and material artefacts to understand how meaning is constructed. To do this, Malafouris (2013) draws from the field of cognitive linguistics and conceptual metaphor theory. Conceptual metaphor theory explains that our ability to construct concepts is grounded in our affective and sensorimotor experiences. Through cognitive projection we can establish a connection between two domains of experience, to construct correspondences between them. This is a process of mapping one domain of experience onto another. The experiential domain, which arises through our affective and sensorimotor experiences of our environment is mapped onto a linguistic domain, such that what we experience as meaningful is expressed through cognitive metaphors. (Lakoff & Johnson, 1980; Lakoff, 2018, Johnson, 2017).

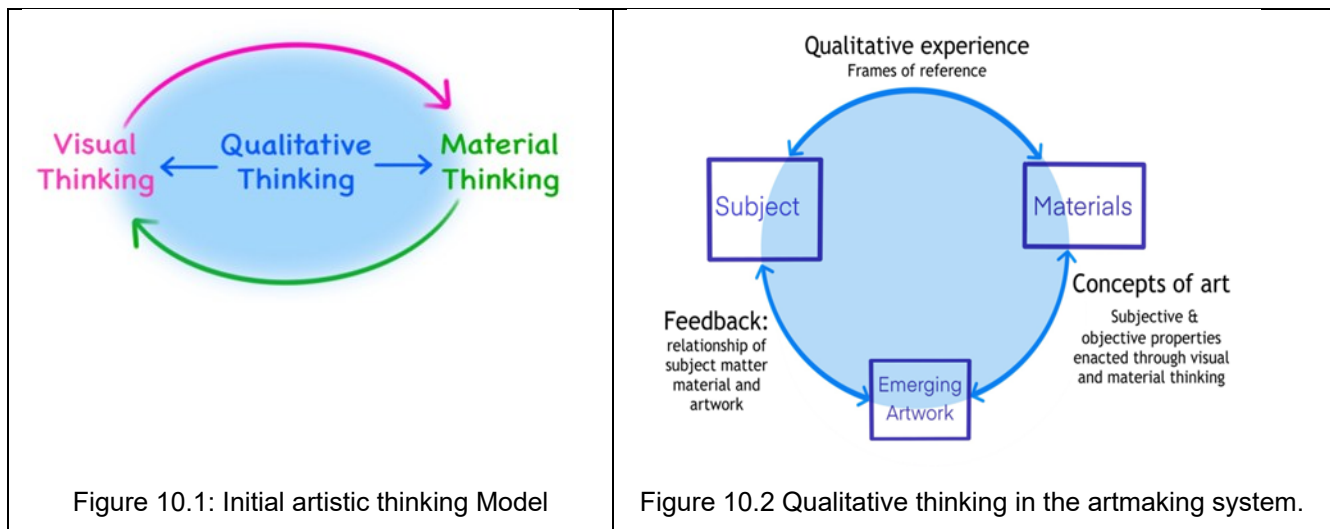
The process of projection and mapping that was discussed in visual and material thinking is also applicable to qualitative thinking. Throughout the artmaking process the artist is making choices and decisions that are mediated by qualitative thinking and enacted through visual and material thinking. In the artmaking process the artists is mapping the experience of the subject matter onto the materials. The artist expresses one thing in terms of another (Kirsh, 2009; Malafouris, 2013). The challenge for the artist is to determine how their personal experience of the subject can be coherently communicated through the materials. For example, Mary is interested in creating a painting that communicates something about adolescents exploring their environment, and that expresses feelings of mystery and anxiety.

The painting (Figure 8.13) is a visual subject of young people discovering something that is glowing but unseen to the observer of the painting, which creates a feeling of mystery. Mary is also interested in communicating her ideas of a creepy, alien experience. She is determining how to convey these qualitative experiences through the materials by focusing her attention on colour, shapes, proportions, light and shadow. By choosing unnatural skin colours such as

green blue and violet, Mary is projecting her qualitative ideas onto the materials. Her visual and material choices and decisions are mediated by the qualitative feelings that she wants to project.

Integrating qualitative thinking into the ATM

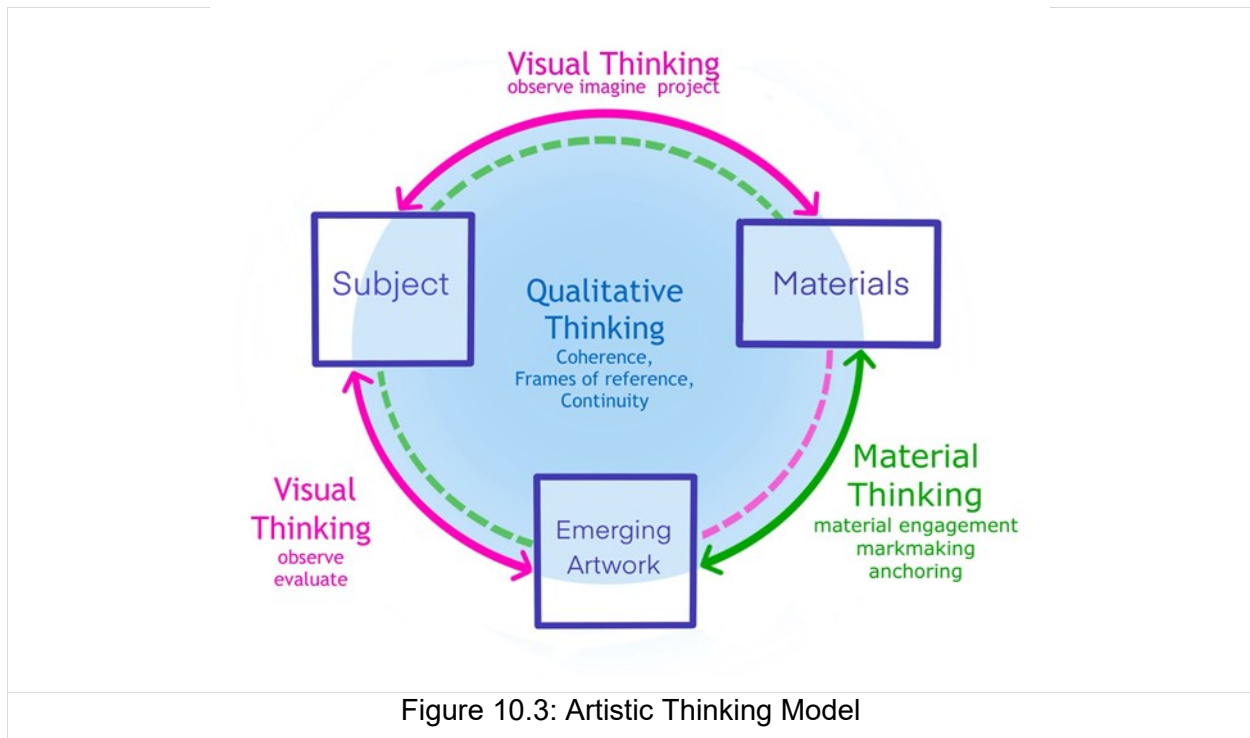
At the beginning of this research, Qualitative thinking was described as a mode of thinking that mediates visual and material thinking as illustrated in Figure 10.1. The relationship of qualitative thinking to the elements of the artmaking system is illustrated in figure 10.2.



Within the artmaking system, an artist's experiences will elicit interest, curiosity and certain concerns, which will motivate a process of inquiry. Qualitative thinking represents what and how the artist feels about the subject and establishes the frames of reference to explore the artmaking subject. The artist's 'concepts of art' establishes connections between the artmaking subject and the materials. Throughout the artmaking process, the artist's qualitative thinking is mapped and projected through the materials onto the emerging artwork. The continuous feedback between the emerging artwork and the qualitative experience of the artmaking subject will frame the artist's choices and decisions to push forward with the process or take it in different directions.

Figure 10.3 illustrates how qualitative thinking integrates into the artmaking system. Unlike visual and material thinking, qualitative thinking is not a specific action, rather it frames the artist's choices, actions, and decisions. The artist may or may not be actively aware of their

qualitative thinking throughout the process, but it is always operating in the background through their skills, beliefs and values (Searle, 2004).



Summary of Qualitative Thinking

Qualitative thinking is a complex process that integrates emotions, feelings and personal experiences into artmaking and plays an important role in motivating the artist to engage in creative inquiry. Drawing from the work of John Dewey (1998) and neuroscientist Antonio Damasio (2010, 2018), the characteristics of qualitative thinking include:

- Context: Qualitative thinking situates thinking in the subjective experiences of the artist and their sociocultural environment.
- Coherence: Qualitative thinking unifies the different aspects of experience into a coherent whole.
- Catalyst: Qualitative thinking acts as a catalyst for further understanding and exploration.
- Frames of reference: The qualitative nature of thinking guides artistic decision making.

Enactive cognition and dynamic systems theory highlight how the affordances of qualitative experience bind the elements of the artmaking system together through the

complementary interactions between the artist, the artmaking subject, the materials, and the emerging artwork. The brain-body-environment forms a dynamic system that leads to sense making. Sense-making involves recognizing affordances, making meaningful choices and adapting to creative challenges.

The artist case studies demonstrate how personal experiences, and emotional states drive the artistic process. The participant studies show that the artistic process is often non-linear, exploratory, and open-ended. The participants demonstrated that QT functions through their personal experiences, the explorations of their subject matter and material interaction. Studying qualitative thinking provides deeper understanding of creative processes by revealing how artists transform personal experiences into visual and material forms. It illustrates that emotions and personal experiences are fundamental to artistic expression and are deeply integrated with visual and material thinking.

Chapter 11. Summary of Research Findings

This chapter presents a summary of the research findings, followed by an analysis of two case study artmaking demonstrations using the artistic thinking model, with potential applications for developing teaching content.

The aim of this research has been to understand artistic thinking through the frameworks of embodied cognition and material engagement theory (MET). My central argument is that the thinking involved in the material process of artmaking emerges from the complex, dynamic interactions between brain, body, and environment, and that meaning is generated through these interactive embodied processes. Building on the early development of the Artistic Thinking Model (ATM) from my master's research, this research refines and revises the model through participant research with professional artist-teachers. The following is a summary of the central research findings.

1. Through dynamic systems theory, the resources used in the artmaking process are conceptualised into an artmaking system whose goal is to make an artwork.
2. Each element in the artmaking system has affordances that contribute to the goals of the system.
3. Thinking is an embodied, multi-modal process that is constituted through the reciprocal and complementary cycles of action and perception.
4. The ATM, when integrated into the artmaking system, is a method of analyzing and understanding how visual, material and qualitative thinking are embodied, enactive and extended thinking processes that interact to achieve the artmaking system's goals of creation.
5. Visual and material thinking are embodied thinking processes that are realised through the action-perception cycles of the artmaking process.
6. Qualitative thinking integrates subjective experience into the thinking processes of artmaking.

The artmaking system

The material process of artmaking brings together different resources that initiate a complex series of interactions, characterized as a dynamic system. An artmaking system is comprised of an artist, an artmaking subject, materials and an emerging artwork. Each element offers a distinct contribution to the system's goal of creating art.

- The artist brings personal experiences and a concept of art which includes a philosophy of art, approaches to making art, the skills to achieve artmaking goals, and knowledge of the art world.
- The artmaking subject can be a topic of inquiry, theme or concept that may or may not have a visual structure at the outset. It may or may not be derived from an observable reference. A conceptual correspondence between a topic of inquiry and the formal visual subject is constructed during the artmaking process.
- The materials include the raw materials, the tools and supports for the creation of the artwork.
- The emerging artwork: The artwork progressively evolves through the material process to emerge as a finished work.

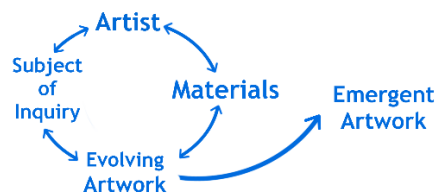


Figure 11.1. Artmaking System

The elements interact in an iterative fashion as illustrated in figure 11.1. The core characteristics of a dynamic system are non-linearity, self-organisation, feedback loops, and emergent outcomes.

Non-linearity: The final artwork is not determined by the initial state of the resources. An artwork can go through multiple iterations before it is fully developed, during which ideas and outcomes can change in response to the interactions of the elements. This was demonstrated in the painting process of Mary, who described how her ideas evolved as she went from one sketch to the next.

Self-organisation: the artmaking system will react and change to perturbations and alterations in the system's elements. An artmaking system can be studied through an artist's single artmaking process or across their practice. The artwork constantly changes through the process, and there may be accidental or unforeseen changes that could take the work in a different direction. For example, at the end of the sculpting process, Claudine decided that the

face was in a moment of reflection and spontaneously decided to add a hand to enhance the expression.

Feedback loops: Throughout the artmaking process, the artist will assess the progress of the work. Assessment may include determining how the visual structure aligns with the artmaking subject, or if the material process is communicating the artist's intentions. Assessments are crucial to how the work will proceed to the final goal. Each of the artists regularly stood back from their work to reflect and assess how it was evolving.

Emergent outcomes: The goal and outcome of the artistic process evolves and depends upon the interaction of the elements of the system. The unforeseen outcomes, the various directions that the work can take, and the crucial role of feedback loops demonstrate that the final goal of the artwork is generated through the ongoing interactions and interrelationship of the elements of the system.

Perception and action in the artmaking process

The artmaking system is an embodied thinking system. Thinking is constituted in the artist's reciprocal process of action and perception. Each element in the artmaking system has affordances that provide opportunities for action and perception, playing a crucial role in achieving the goals of the system. The relative nature of affordances depends on the goals of the system and the ability of the artist to apprehend and use them. For example, Michael's use of oil paint and an observable still life subject affords him the opportunity to perceive colour relationships. Michael's skills in painting and drawing afford him the ability to create a wet on wet oil painting that depicts juicy thick coloured shapes.

Through perception, the artist discerns the affordances of the elements which leads to action. Every material action adds new information to the system which in turn presents opportunities for new perceptions, and as such the interactive cycle continues throughout the process. Action and perception are reciprocal and complementary processes that facilitate feedback loops to determine the ongoing actions of the process.

Artistic Thinking Model

The ATM represents three modes of embodied cognition that can be used to analyse and describe how thinking occurs during the material process of artmaking. These are visual thinking, material thinking and qualitative thinking, as illustrated in figure 11.2.



Figure 11.2 Initial Artistic Thinking Model

In the ATM, visual and material thinking are embodied through the ongoing cycles of perception and action. Qualitative thinking establishes coherent frames of reference throughout the artistic process. It mediates visual and material thinking, motivating the decisions and choices of the artist. Figure 11.3 illustrates how the three modes of thinking are integrated into the artmaking system.

Observation, visualization and projection connect visual thinking to material thinking. The artist will visualize information based on the goals of the process. Projection connects visual and material thinking. During projection, the artist is assigning physical characteristics to what is observed and imagined. The reciprocal relationship between visual and material thinking means that what is projected is directly related to the material methods and techniques that the artist is using. The implication is that visual and material thinking are not isolated thinking processes and should be analyzed in relation to each other.

Visual thinking as an embodied thinking process

In the artmaking process, visual thinking contributes to how the artist perceives, selects, and organizes information to transform and communicate it using visual/spatial structures. Visual thinking uses various forms of reasoning that include analogical reasoning, top-down and bottom-up reasoning, focused attention, simplification, schematization, abstraction, and synthesis. Observation, visualization and projection connect visual thinking to material thinking as part of the action/perception cycles of artmaking.

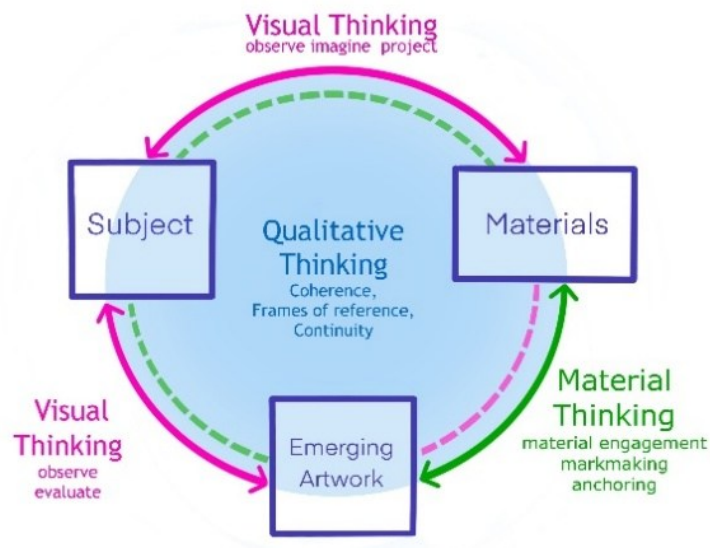


Figure 11.3 Revised Artistic Thinking Model

- The visual structure of the artwork is derived from the sources of information that the artist assembles for the process. The visual form of the artwork may or may not resemble the resources.
- Visual thinking uses analogical reasoning to map information from one domain of experience onto another. Analogical reasoning establishes a visual and conceptual correspondence between things that can be observed in the environment with the visual/spatial structures that are constructed in the artwork.
- Visual thinking uses top-down and bottom-up reasoning. Specialized domain knowledge is used to guide and inform what is actively perceived in the elements of the artmaking system. This includes visual thinking processes such as focused attention, visual analysis, schematization, abstraction, synthesis. Top-down and bottom-up reasoning are reciprocal cognitive strategies that represent the dynamic relationship between perception, action and intention. The ability to articulate this relationship facilitates conceptualization and knowledge transfer for teaching.

Material thinking

Material thinking is the construction of the visible, physical structure of the artwork. It is demonstrated through material engagement and mark-making. The principles of material thinking include:

- Materials have foundational affordances that are crucial to learning how to think through materials. These are material properties, methods, tools, techniques and mark-making.
- Through embodied cognition, thinking is structurally coupled with the materials. The transformation of materials occurs through the reciprocal affordances of artist-material.
- Material thinking and visual thinking establish a reciprocal and complementary relationship represented by the action-perception cycles of the artist and the elements of the system.
- The concept of projection represents the transition from visual to material thinking and supports the pragmatic decisions undertaken through material actions. The artist's embodied actions result in material transformations and mark-making to anchor the materials onto the emerging artwork. It is how the artist makes sense of the artmaking subject through the materials.
- Extended cognition describes mark making as epistemic actions. The artist transforms the artwork, which in turn transforms the artist's thinking process. This establishes reciprocal feedback loops between the elements of the system. Material transformations enable the artist to advance how and what they think about the work as it evolves.

Qualitative Thinking

Qualitative thinking is a complex process that integrates emotions, feelings and bodily experience into artmaking. The characteristics of qualitative thinking include:

- **Context:** Qualitative thinking is grounded in the concerns and lived experiences of the artist, which situates and motivates the artistic process.
- **Frames of reference:** The artist's situated experiences, interests and knowledge are the frames of reference that guide the choices and decisions of the artist
- **Catalyst:** The elements of the artmaking system have reciprocal qualitative affordances that are grounded in the artist's experiences and are catalysts for action. The experience of the subject affords subjective response, the experience of materials affords transformative mark making, and the artwork affords the evolving interpretation of the materials and the subject.
- **Coherence:** Qualitative thinking is holistic. It binds the elements of the system together into a cohesive whole and establishes the overall mood of the work. As such qualitative thinking mediates the choices and decisions that are part of visual and material thinking.

Qualitative thinking is sense-making. Meaning is constructed through the artist's ability to make sense of their experience of the subject through the materials.

Application of the ATM

This section examines the application of the ATM through the analysis of a specific artmaking process. The objective is to articulate how thinking is embodied in the process and to develop pedagogical content. Analyzing the artmaking process with the ATM is the first step in conceptualizing the process to articulate content knowledge. This section begins with a general framework for analysis, followed by questions to guide the analysis of the artmaking process using the modes of thinking of the ATM. This is followed by an analysis of the artmaking demonstrations of Genevieve and José.

The stages of analysis:

1. The artmaking system: The elements of the artmaking system are described. This includes the artist's concept of art, the artmaking subject and materials.
2. The artmaking process is documented using film or photos.
3. The first level of analysis breaks the artistic process down into the various stages of the evolution of the artwork. Each stage is framed through the visual and material objectives that are achieved. The concepts of focal and subsidiary knowledge can facilitate this analysis.
4. The second level of analysis examines the stages of the process through the three modes of thinking. The modes of thinking are analyzed through the concepts of visualization, projection and mark-making.
5. Based on the analysis, potential concepts for teaching are proposed.

Questions to guide the analysis:

Observation, visualization, and projection occur during the action-perception cycles of visual and material thinking. The visual thinking objectives are transformed through the processes of projection and anchoring. Projection connects visualisation to material thinking through decision making. Anchoring implies the transformations that occur during material thinking. By describing visual and material thinking, it is possible to articulate the relations between them and potential concepts for teaching.

Visual thinking:

- What is the artist's visual focus?
- What visual form or structure is created?
- What is the reasoning process that is used? For example: analogous reasoning schematization, abstraction or synthesis?
- What is the artist visualizing and how does this lead to projection and anchoring during material thinking?

Material thinking:

- How are the materials used to achieve the visual structural goal?
- What are the actions taken that support visual projection and anchoring?
- Describe the material actions through the fundamental affordances of the materials: properties, methods, technical applications.

Qualitative Thinking:

Qualitative thinking situates the artmaking system in the subjective experiences of the artist, establishing coherence between the elements of the system. The visual and material thinking processes are mediated by qualitative thinking. Understanding qualitative thinking can be guided by questions such as:

- How does the artist contextualise the material process and the subject?
- How does the experience of the artist, subject and materials come together to motivate the artistic process?
- What are the frames of reference that the artist uses to guide the process?
- Is there an overall feeling or mood that binds the work together?

ATM Application: Case study with Genevieve

The artmaking demonstration was filmed for a duration of 1 1/2 hours. Following the demonstration, the video was viewed several times and approximately 150 still frames were extracted and saved as digital photos. The photos were progressively reduced to the 7 images that are shown below to illustrate the steps of evolution. The photos represent Genevieve's embodied actions and the transformation of the canvas. Each stage of the process is analysed

through the three modes of thinking. The analysis begins with a description of the elements of the artmaking system: concepts of art, artmaking subject, and materials.

Genevieve's Concept of art:

Genevieve has described her work as empathy art. Genevieve is motivated by events that deal with existential challenges that involve physical and psychological suffering. These events come from the news as seen on television, podcasts or news magazines.

“And there was always a story in the news that was sad and hard, very difficult to read. And I would just not get over it. And these images would just kind of stay within me...My feelings towards these difficult stories just kind of took over and I would put them always on paper.” (Genevieve, Interview 1.)

Genevieve's material process can be described as mixed media. Her process combines drawing and painting. Her compositions are often comprised of image fragments of the human body. She adds and removes material resulting in a complex image that uses multiple layers of material.

“Most of my work is drawing and erasing and painting. So, it's applying and erasing, I have this kind of movement going on, I work a lot with the body, the notion of the body, repetition movements.” (Genevieve, Interview 1.)

Materials:

For the demonstration, Genevieve used charcoal sticks, acrylic paint, a disposable palette, brushes, rags and water. She brought a large canvas that had a partial painting on it which she had previously abandoned.

Artmaking Subject:

As discussed in the section on qualitative thinking, the catalyst for Genevieve's artmaking process and subject matter was her personal connection to events that she had recently experienced. She initially described the artmaking subject in vague terms. It was more of a subject to discover through the material process. This open-ended approach is characteristic of her artistic practice. Below are some of her remarks regarding the subject matter she was about to create:

“No idea. I brought three canvases. There’s a smaller one a larger one. This is just an old canvas that have never finished. I like working larger. And I don’t know, I’ve seen all these things this week that are super influencing me.”

(Genevieve, Pre-Demonstration Interview)

She mentioned how she was affected by a documentary about a public media figure who had committed suicide:

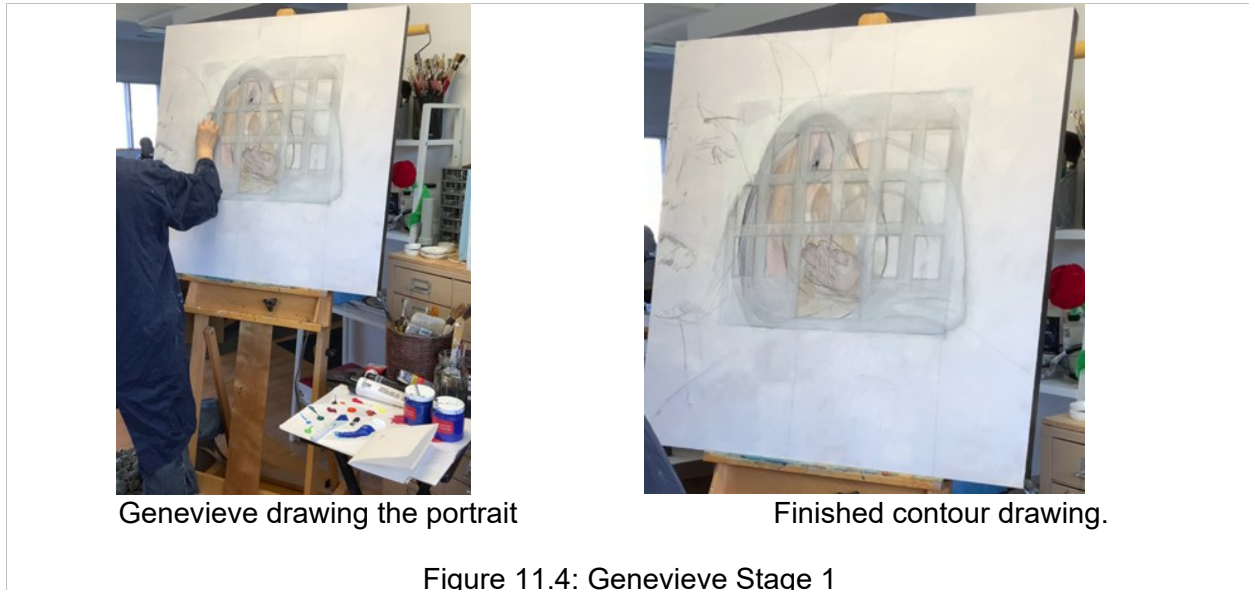
“It’s just kind of like the journey and how it ended up. he killed himself at the end...I’m really attracted to it, I understand his life. I totally understand his life but just the way it was filmed.” (Genevieve, Pre-Demonstration Interview)

At the end of the demonstration, although the painting was not finished, she described the subject matter as physical and psychological suffering, linking it to the notions of suicide and emptiness. With that in mind, the following section will analyse the painting process by applying the ATM to the stages of evolution of the artwork.

Analysis of the painting demonstration:

This section is an analysis of the stages of Geneviève’s painting demonstration. Each section begins with a description of the goal for the stage of the painting, followed by a brief analysis using that ATM. Each section is supported with photos from the video demonstration. The photos illustrate her interaction with the materials and the emerging artwork, and the changes that are made to the canvas.

Stage 1: Initial portrait drawing with charcoal and acrylic paint.



A portrait is added to the left side of the canvas, partially obscured by the grid shape that is already present on the canvas. It is initially drawn using charcoal, then acrylic paint.

Visual thinking: Genevieve's visual focus alternates between a reference image from a magazine, and the canvas.

Analogous reasoning & schematization: The reference image is analysed to extract visual information that simplifies the portrait into a linear contour drawing.

Visualizing-Projecting-Anchoring: Information is visualized as linear shapes, connecting visual thinking to the material drawing process.

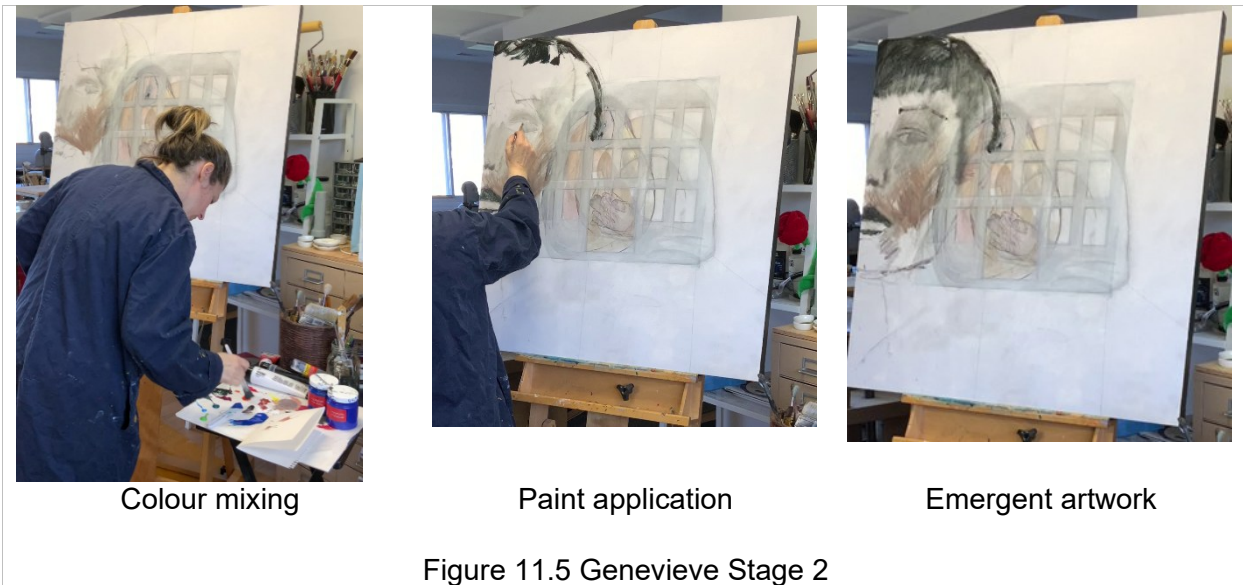
Projection: Genevieve determines the proportions of the portrait in relation to the size of the canvas and the compositional form that is already present.

Anchoring through Material thinking: She creates a contour outline of the portrait, anchoring what she has visualized and projected onto the canvas.

Qualitative thinking: The large proportions of the face gave it visual importance.

Subsidiary knowledge: The initial portrait drawing calls for an understanding of how to observe simplify and structure facial anatomy. She is also applying the skills of contour drawing and relative proportions.

Stage 2: Visual emphasis of the portrait



The goal is to pull face forward in space using neutral tones of colour. This accentuates the portrait and emphasizes its importance.

Visual thinking & Visualizing: Genevieve's visual focus is on the appearance of the portrait relative to the existing composition. Visual concepts include depth of space and contrasts.

Visualizing-Projecting: She is determining how to accentuate the face using tonal contrasts. The tones do not mimic natural skin tones, nor do they model the face.

Projection and Anchoring through Material thinking: determining the material actions needed to enhance the definition of the face:

- Neutral dark colours are mixed on the palette with acrylic medium. Colour mixing supports visualization and leads to anchoring.
- Anchoring: scrubbing technique of paint application to achieve semi-opaque colour.

Material affordances: Understanding paint density and opacity, acrylic paint application to achieve opaque or semi-opaque colour.

Qualitative thinking: The neutral colours and strong contrasts create a feeling of ambivalence and tension. The face takes on greater weight and importance because of the strong contrasts.

Subsidiary Knowledge: Applied colour theory: knowing how to mix tones of colour. Visual concepts of depth and tonality.

Stage 3: Ghosting the Face: reducing the opacity of the portrait

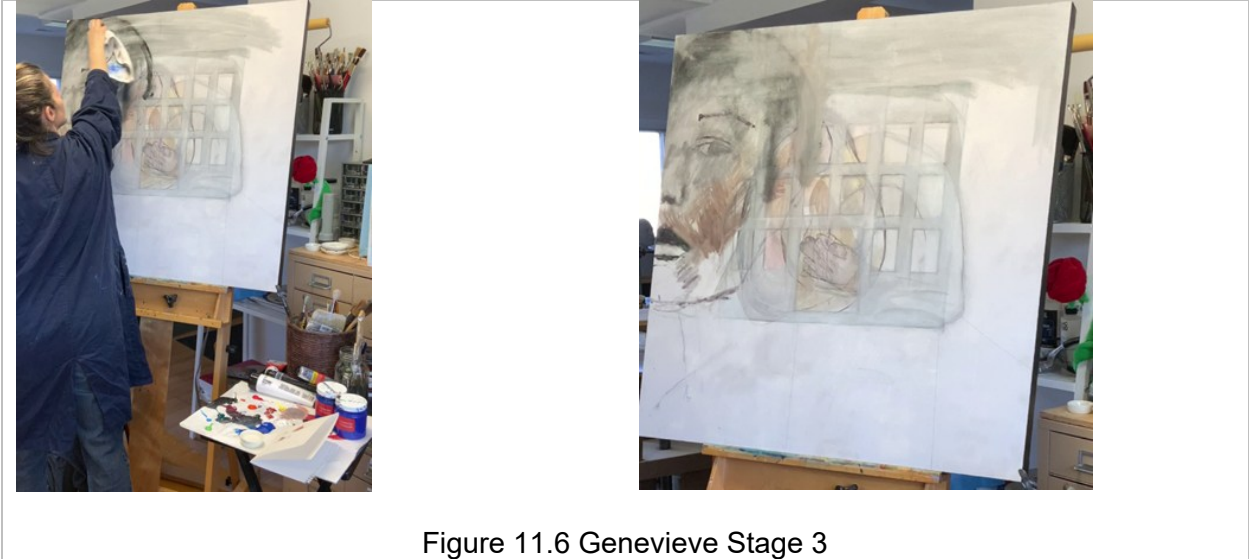


Figure 11.6 Genevieve Stage 3

Ghosting implies transparency and depth of space:

"I'll draw part of the face, and it's too complete for me, I'm uninterested. And so I'll start erasing. And then there's like ghost images left behind. And then then it's exciting. And I kind of, you know, I re-emerge, and I pushed back and stuff like that." (Genevieve, Interview 1)

Visual thinking & Visualizing: Visual focus is the tonal structure of the portrait relative to the composition. She is visualizing how to push the portrait back in space so that it appears behind the grid shape. This implies comparing the different elements of the composition. The stark white of the canvas can be interpreted as infinite background space or complete flatness.

Projecting - Anchoring through Material thinking: Projection is determining where to lift paint away. It is anchored through the actions taken with material thinking.

Material Thinking: A rag dipped in medium is used to remove paint and spread it across the canvas. The portrait is rendered semi-opaque

Qualitative thinking: The portrait takes on a dream-like quality. It no longer has the visual force of presence that was previously established.

Stage 4. Contoured drawings of hands



Figure 11.7 Genevieve Stage 4

With the aid of reference images (left frame of figure 11.7) Genevieve draws of hand shapes over the face. She begins with charcoal and then outlined the contours using a fine round brush and acrylic paint. The hands become a repeating motif in the composition.

Visual Thinking & Visualizing:

- Visual focus alternates between reference image and canvas.
- Analogous reasoning for visual structure: extracting information from reference photos to structure the hands.
- Simplification: reference image is analysed and a linear schema is visualized.

Projection and Anchoring through Material thinking:

- Visualizing information as linear shapes connects to material process of charcoal line drawing.
- Projection: Determining the proportions of the hands connects to the size of the hands to the face and grid.

Material thinking: The contour lines are anchored onto the canvas with the charcoal and then reinforced with acrylic paint. This includes the actions of mixing paint with medium and water, using a fine round brush to delineate shapes with paint.

Qualitative thinking: The hands are ambivalent and add tension. Genevieve describes it as the hands “pushing against the face” (Genevieve, Post-Demonstration interview)

Stage 5. Depth of Space & Portrait



Figure 11. 8 Genevieve Stage 5.

The lower area of the portrait was covered with a neutral field of grey paint. The sense of depth in the composition is further reduced, adding a dream-like quality to the work.

Visual thinking-Visualizing: Visual focus is on depth of space and reducing the details of the facial features. Visualizing is the effect of an abstract field of colour on the lower face.

Projection and Anchoring through Material thinking: Projection determines the colour, paint density and size of the colour field. This is anchored through the actions of material thinking.

Material Thinking: Neutral tones of grey are mixed on palette and scrubbed onto the surface.

Qualitative thinking: Overpainting the mouth can be interpreted as the negation of the person. It may indicate the inability or difficulty to express oneself.

Stage 6. The forearm is given stronger visual emphasis



Figure 11.9 Genevieve Stage 6.

Attention is focused on the forearm and hand that emerge from the confinement of the grid. Neutral warm colour is added to the forearm, and the upper arc shape is reinforced with white paint. The visual effect pulls the arm forward in space and the grid appears to become more transparent. The warm colours contrast with the dark neutrals applied to the face.

Visual thinking-Visualizing: Visual focus is on the appearance of the forearm and hand to the left of the canvas. The goal is to pull the arm forward in space and give it greater definition.

Projection and Anchoring through Material thinking: Projection is assigning colour and value to the shape of the forearm.

Material Thinking: Colours are mixed on the palette (left frame of figure 11.9), and the forearm is carefully delineated with attention to the contoured edges. The paint is lightly scrubbed over the canvas to create a semi opaque layer of paint that leaves the traces of the grid still apparent (right frame of figure 11.9).

Qualitative thinking: the arm reaches forward into space as if it is trying to escape the confinement of the grid. It establishes a stronger relationship with the portrait.

Stage 7. Colour fields are added to either side of the composition.



Figure 11.10 Genevieve Stage 7.

During the final stage of the demonstration, Genevieve covers certain elements of the composition. The visual effect is to further reduce the depth of space of the composition. This is another example of what Genevieve described as 'ghosting'.

Visual thinking-Visualizing: The visual focus is on the relationship of the elements of the composition, the illusion of depth of space and the reduction of details that articulate shapes. She is balancing the two edges of the composition: the right and upper edges of the portrait and the left area where the arm projects from the grid.

Projection and Anchoring: To achieve the goals of visual thinking, projection includes selecting the areas of the canvas to overpaint with fields of semi-opaque tones of paint.

Material Thinking includes the actions of mixing specific tones of acrylic paint with acrylic mediums and water to achieve the desired consistency and opacity of paint. The paint is scrubbed onto the surface of the painting. After waiting for a limited amount of time, Genevieve uses a rag to lift off the paint to reveal some of the composition.

Qualitative thinking: The dark tones on the right of the canvas create strong contrasts with the white background and draw attention to the portrait which is now barely visible. The presence of the person is almost obliterated, negating the identity. The warm tones to the left of the canvas accentuate the arm that gestures towards the portrait. The pictorial space is confusing and has a dream-like quality, Space, time and depth defy the natural world. The partially obliterated face that the pointing arm creates psychological tension and an ominous feeling.

Discussion: Multiple Points of Entry for Teaching

The analysis of Genevieve's painting demonstration through the ATM reveals how the complexity of thinking is made visible through her material process. By attending to the visual, material, and qualitative modes of thinking at each phase of the artwork's evolution, it is possible to gain insight into how thinking and action operate together. These insights facilitate the articulation of concepts and forms of reasoning that can be developed into pedagogical content.

The Artmaking Subject

For Genevieve, her chosen artmaking subject is shaped by her interest in the physical and psychological challenges people confront. Referring to my discussion of the artmaking subject as a resource (Chapter 8), this is an example of a subject that is based upon a topic of inquiry and a theme. This can be a particularly challenging way to frame a learning situation because it is an abstract concept that requires a student to search for a means of representing it through visual structure. One approach to developing this theme in a classroom context is to work with conceptual metaphors grounded in physical experience. Looking at Genevieve's artwork, the grid overlaying the portrait may be interpreted as a visual obstruction, a fence or cage, serving as a metaphor for repressed or inaccessible emotion. The dark colour fields may be seen as metaphors for psychological darkness. As Lakoff and Johnson (1980) argue, conceptual metaphors are not solely linguistic or intellectual—they involve our senses, our perception of colour, shape, and texture, and our broader aesthetic experiences. Their strength lies in how they allow us to access and express emotional content through embodied, concrete means.

Visual Thinking

Genevieve's demonstration provides rich opportunities for learning how visual form can be constructed and expressed. Some of the visual strategies that she employed include:

- Proportions and variation: The head appears significantly larger than the hands, creating a visual hierarchy of emphasis.
- Layering of forms: Elements are superimposed without regard for conventional spatial modelling, emphasizing flatness and visual compression.
- Tonal structure: Reduced tonal contrast contributes to a sense of spatial ambiguity and visual cohesion.

- Depth and illusion: The white of the canvas reads as infinite space; dark fields of colour project forward, creating spatial tension.
- Transparency: Achieved through semi-opaque colour fields, linear outlines, and overlapping forms, transparency becomes a visual and conceptual tool.

These strategies contribute to a disorienting sense of space and a dream-like atmosphere. Of particular interest is Genevieve's blending of imagination and observation: although she used photographic references for the portrait and hands, these elements were absorbed and transformed within a broader, imaginative framework.

Material Methods and Strategies

Genevieve's process blends painting, drawing. Her use of fractured forms, layered shapes, and varied proportions recall collage aesthetics. The technique of applying and lifting paint with a rag, creating "ghosted" imagery, is reminiscent of charcoal drawing. These techniques were adapted and integrated into her use of acrylic paint. She employed several acrylic-specific methods, such as:

- Thinning paint with medium or water to achieve semi-transparency.
- Scrubbing to create veiled surfaces.
- Removing opaque layers with a rag, requiring attention to drying time and pigment density.
- Applying knowledge of hue, tone, and saturation for colour mixing.

These techniques were not applied arbitrarily, they were used in service of visual and material reasoning, embedded within the thinking process that shaped the artwork's form and mood.

Qualitative Thinking

For artmaking to be meaningful, it must connect to the artist's personal experiences, interests, and concerns. As discussed in the chapter on qualitative thinking, Genevieve's subject matter reflects this relationship. In the Artistic Thinking Model, qualitative thinking is inseparable from visual and material decision-making. Students can be supported in identifying what is personally meaningful to them and in translating that meaning into visual and material form. Helping students to perceive the expressive affordances of form, gesture, colour, or space is

fundamental to art education. Qualitative thinking emerges through reflection, association, and aesthetic discernment, and it deepens the interpretive dimension of learning.

From Analysis to Pedagogical Application

Analyzing the evolution of an artmaking process through the ATM brings into focus the recursive ways that thinking and action develop together. It allows educators to articulate concepts that are often tacit or embedded in the process, making them available for knowledge transfer and curriculum development. What makes this approach pedagogically generative is that it supports multiple points of entry. Teaching content does not need to replicate Genevieve's process; rather, educators can draw from the visual, material, or expressive strategies that emerge from it.

For example, visual concepts such as spatial depth, the organization of shapes through layering, or an awareness of positive and negative space are fundamental to visual-spatial reasoning. These ideas can be applied across different media and subject matter, offering flexible opportunities for lesson planning. If an educator wants to explore the dream-like quality of Genevieve's work, they might connect this to conceptual metaphors grounded in emotional experience, such as hope, fear, or confinement, inspiring students to explore meaningful abstract concepts through imaginative interpretation of space and form. In doing so, subject matter becomes entangled with visual and material thinking, allowing for expressive and personally relevant learning.

Application of the ATM: Case Study with José

The case study of José's artmaking demonstration offers a rich and nuanced perspective of how to understand processes that go beyond traditional material methods. This section will offer an analysis of Jose's artmaking demonstration using the ATM and followed by pedagogical implications for art education.

José's Artmaking system

Artist's concept of art: José's creative practice is in the tradition of conceptual art. He works with a variety of materials and processes, without specializing in any specific skill. Much of his work is three-dimensional sculptures, assemblages of objects and materials that he collects over time. He is interested in exploring how objects, materials, and processes reveal

hidden aspects of reality across time and space. His work makes open-ended statements or poses questions about life and culture.

Artmaking Subject: The artmaking subject explores concepts of identity and physical presence. More specifically, José explores the relationship between the physical presence of the artwork, and the artist, who is not present when the work is viewed. José has chosen to express these ideas through the creation of a series of portraits of missing people, whose date of birth and gender align with the participants of a graduate course in studio art at Concordia University. The portraits are inspired by photographs that he has searched for on a Canadian database for missing people. Here is how he situated the process:

“I think we have to play with the identity construction of the artist, because in modern art it is so intrinsic to making, you know...the persona is in the work.”

And I'm showing an insight that is inexplicit. So people who are not showing up, showing people that are not explicit in their life. And while we are explicit all the time as artists, these people are not explicit...because they decided, because something happened, because they simply are not, they cannot be present”
(José, pre-demonstration interview).

The portraits were part of a group show that was organised at the end of the semester, where all the students in the class exhibited their work. The portraits created by José establish a relationship between the missing people that they represent, and the artists, whose work was in the show.

Materials: Charcoal, paper, cell phone, online AI painting software, canvas and stretcher bars.

Process method

The artwork goes through several stages of evolution, in which he blends a traditional drawing method, photography, and an AI digital painting generator. Here is a summary of José's method of execution:

- Charcoal drawing of portrait.
- Photograph of drawing.
- Upload photo to online software.

- Experimentation with various painting filters available in the software and choose a filter that represents the desired outcome.
- Download and save painting simulation.
- Print simulated painting on canvas and stretch canvas.
- Repeat this process for the other portraits.

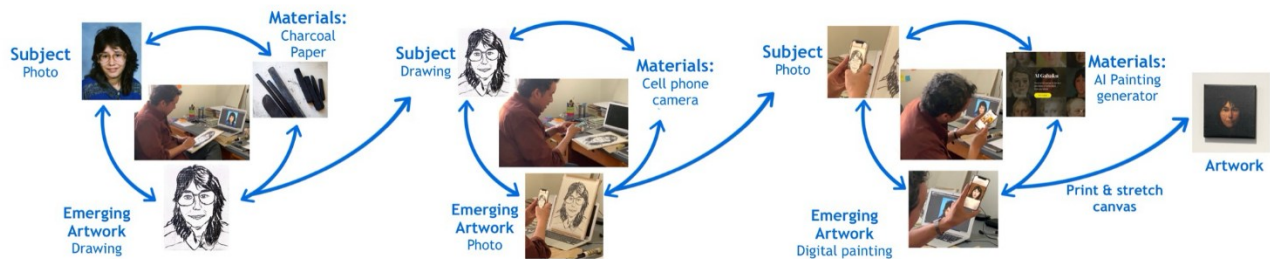


Figure 11.11 Stages of José's artmaking demonstration

Figure 11.11 is a visual illustration of the stages of development using the ATM. Notice that in the three stages of development, Jose uses a different material to generate the emerging artwork. Once a stage is finished the emerging artwork becomes the artmaking subject for the successive stage.

Stage 1: Working from observation José begins the drawing process of a portrait. The artmaking subject is a photo of a missing woman that he observes on his laptop. The material is charcoal and paper, and the emergent artwork is the finished drawing.

Stage 2: José creates a digital photo of the drawing. In this stage, the charcoal drawing from stage 1 becomes the artmaking subject, the material is the cell phone photo app, and the emergent artwork is the resulting photo.

Stage 3: The digital photo is transformed into a digital painting using online software. The digital photo is the artmaking subject, the online software is the material, and the emergent artwork is the painting simulation that is generated by the software.

The final stage of the process entailed printing the digital painting on canvas and stretching it so that it resembles a traditional painting.

Analysis:

The first stage of the process is a traditional artmaking approach. José uses visual thinking to observe, analyse and structure a drawing using analogical reasoning; he is mapping what he perceives onto the drawing paper. A complementary relationship is established between visual thinking and the foundational affordances of material thinking. Through visual thinking, he analyzes the portrait photo to extract information about the edges and contours of the portrait features. The contour drawing method aligns with the affordances of the charcoal, which facilitates the creation of strong dark linear mark-making. He visualizes and projects specific information that he observes in the portrait photo. His visual projections are anchored onto the paper through mark-making.

When I asked José why he chose to draw the portrait, when he could have directly uploaded the photo to the software, here is his response:

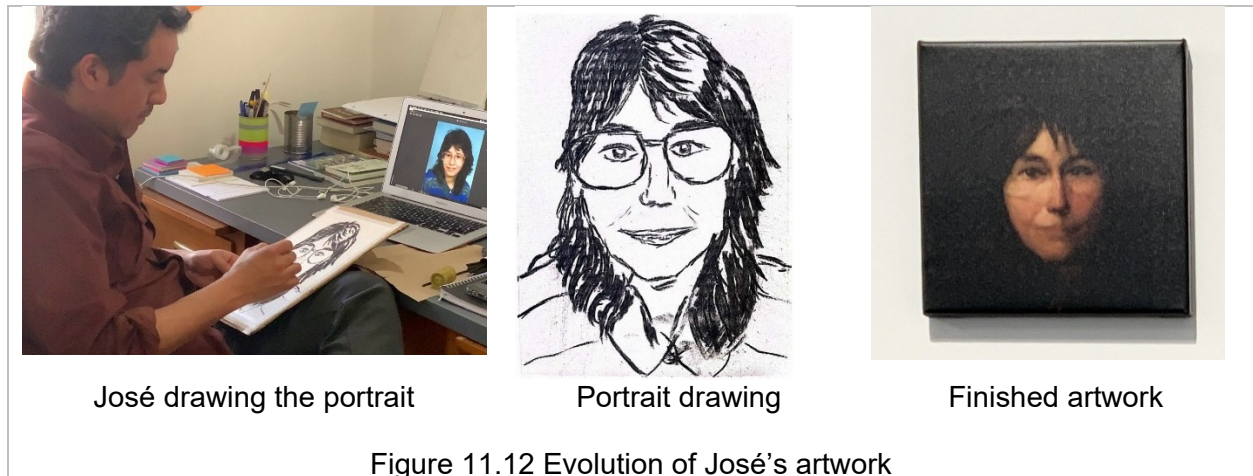
"[S]o it's like passing through me somehow. I think I like the relationship that I have with the person when I'm drawing because it's like you are observing, it's like having a relationship... You're taking your time with this person, it becomes personal. It's your interpretation. Of course, I don't consider myself a very good technical drawer." (José, post-demonstration interview)

In stage two of the process, José uses his cell phone to take a photo of his finished drawing with the aim of uploading it onto the online software that will generate a digital painting simulation. The cell phone is a material tool that facilitates his actions and intentions. The cell phone affords photography and the ability to upload the photo onto the online AI painting generator. Once the photo is taken, it becomes the emergent artwork that is used in the next stage of the process.

During the third stage, José uses the AI painting generator to explore different possible outcomes by experimenting with the various painting filters. Once José determined the photo filter that best suited the outcomes that he was searching for, he saved the digital painting on his laptop. In the final stage of the process, José printed the digital painting on canvas and stretched it onto wooden stretcher bars, thereby creating the impression of a traditional painting.

The subsequent transformation of the drawing into a painting using generative AI introduces a novel form of artistic thinking, where the material thinking phase becomes partially

automated yet still framed by José's ideation and aesthetic intentions. Rather than viewing this as creative outsourcing, Jose's method demonstrates a shift in problem-solving and decision-making, as he explores, curates, and interprets the AI-generated outputs. Figure 11.12 illustrates the different aspects of the process, including the finished artwork, which I viewed at the exhibition that was organized at the end of the semester in 2022.



Qualitative thinking:

In the interviews, José expressed how the creation of this artwork is grounded in his interests and concerns as an artist. The concepts of physical presence through time and space in relation to the artist and the artwork are ideas that he has explored in previous artworks, establishing a connection to his ongoing practice. He was motivated to further explore these ideas in the context of his painting class by implicating the other course participants. The work and the process is infused by the concept of connectivity: the connection to past work, the connection to his classmates, and to concerns of the artworld. Through his drawing process he forges a personal connection to the portrait subjects. José established a powerful conceptual, physical and emotional coherence between these elements.

When I asked him why he chose the filter that led to the final visual structuring of the composition, here is his response:

“And I chose two or three different filters that are similar, of course, related more towards Renaissance painting or, chiaroscuro painting.”

I looked for loneliness and obscurity in this kind of painting because there's no background. And the lack of background makes something un-situated.

I think that idea of not matching, of not giving a clue of where is this person, and also it gives her time distance. So it's like somewhere else, that is totally not connected to this moment and not connected to this space. That's what it just felt correct to do.” (José, post-demonstration interview)

José has made qualitative decisions that are crucial to meaning construction. In the final work, (figure 11.12, frame 3) the portrait that partially emerges from the dark background is a visual metaphor for someone who is distant or lost in time. The lack of precision of the portrait features enhances this mood. José’s choices contribute to the affective outcome of the portraits as individuals who are present only in the artwork, but whose physical location is unknown.

Pedagogical implications:

Developing pedagogical content based on José's process can focus on the artmaking subject, the methods that he used, or both. The artmaking subject can be framed as a topic of inquiry, which in this case is the relationship of identity and physical presence. Identity construction and representation is a fertile area that can be examined through the portrait but is not limited to it. It is ultimately up to the educator to determine how open-ended the artmaking process should be, based on the abilities of the learners. Alternatively, a pedagogical framework can explore José's hybrid artmaking method, engaging students in a process that integrates observational drawing with generative AI. The next section will examine the relationship between traditional drawing and the use of AI software.

Observational Drawing:

An observational drawing process calls on the three modes of thinking in the ATM. Visual thinking is developed through direct observation to understand and generate visual structure. The genre of portrait drawing is a traditional learning topic that can be framed through learning how to identify the shapes and proportions of facial anatomy. In the drawing process, visual thinking is embodied through the processes of observation, visualization and projection onto the materials. José chose to do a contour drawing of the portrait in charcoal. This ties visual thinking to material thinking. Visual focus is on edges, shapes and proportions rather than on subtle tonal structures. Qualitative thinking emerges through the sense-making experience of

the drawing process and is reflected by the mood of the drawing, and what the student considers to be pertinent in formal and compositional choices.

Co-authorship with AI

When interacting with AI painting software, the three modes of thinking are tightly bound together. The AI extends thinking processes and offers ways of visually structuring artwork that may be novel and unexpected. Material thinking emerges as students interact with AI not as a neutral tool, but as a responsive medium that reshapes their work, prompting reflection on affordances, unpredictability, and agency. Qualitative thinking is fostered through interpretive reflection on authorship, meaning, and affect, as students assess how both their intentions and the AI's responses co-construct the final image. This approach positions artistic thinking as a dynamic process that unfolds through human vision, technological mediation, and material transformation.

Summary

This chapter summarized the research findings and demonstrated how the Artistic Thinking Model can be applied to analyze artmaking processes, highlighting its potential implications for practice-based research and pedagogy. As a method of inquiry into the artmaking process, the ATM can be used as a method of task analysis to understand processual methods, and how principles and concepts of artmaking are tied to embodied ways of thinking. Once articulated, these concepts and principles become content knowledge that can be transferred into pedagogical content. Pedagogical content development would then require educators to adapt content knowledge into pedagogical goals and outcomes that are relevant to the age and level of the learners.

Visual Thinking draws attention to perception, spatial organization, and formal relationships, enabling students to explore how to structure and communicate ideas through visual compositions. Material Thinking encourages students to experiment with surfaces, media, and processes, recognizing materials as crucial extensions of reasoning for the development of form and ideas. Qualitative Thinking fosters personal resonance and expressive intent, guiding students in translating affect, memory, and interpretation into visual formal structure. Each mode offers an entry point for teaching artmaking processes. They need not follow a hierarchy of application; educators can design lessons that oscillate between them or emphasize one mode

more strongly based on context or student need. This flexibility supports a non-linear, student-responsive pedagogy that mirrors the recursive, self-organizing nature of artistic thinking itself.

It positions the studio as a complex system, materially grounded, context-dependent, and generative of knowledge, in which cognition and creativity evolve in relation to the act of making. The next chapter will continue this reflection on teaching and the development of pedagogical structure by positioning the ATM through the concept of problem solving.

Chapter 12: The ATM as a problem-solving model for teaching

This chapter examines how the ATM can be used to develop pedagogical content. The discussion offers a brief overview of problem-solving theory and then positions the ATM as a problem-solving framework that can be used for organizing pedagogical content. I will draw from the various case studies to devise possible teaching applications.

Problem-Solving and Structure:

Problem structure exists along a relative scale. Structure depends on how the problem parameters are defined, the complexity of the problem-solving process, and if the outcomes are known (Jonassen, 2004; Robertson, 2017). In a well-structured problem, the parameters of the problem to be solved are well-articulated; the process for achieving the outcome is clear and the outcome is known. If any of these parameters are not known or not clearly defined, the problem becomes less structured, increasingly complex, and calls for interpretation. The outcome of an ill-structured problem is not known in advance, nor is there a single correct outcome. Rather, the outcome exists on a scale of relatively good or bad results which are assessed qualitatively (Jonassen, 2004).

How a learning assignment is framed as a problem will determine the extent to which it is ill-structured or well-structured, which becomes a factor in how open-ended the outcomes may be. Complexity and structure are believed to be attributes of creative problem solving (Treffinger et al., 2008). The more ill-structured, complex and open-ended a problem is, the more a student will have to use skills of interpretation, imagination, and search for unarticulated solutions. When devising the structure of the problem, a teacher should consider the knowledge and skills of the students, when and where scaffolding is needed. If a problem is too open-ended and the students lack the skills to interpret the problem, or the material skills to create an artwork, they may not be able to successfully engage with an assignment. On the other hand, if the problem is too structured, students may not find the problem sufficiently interesting or challenging (Runco, 2014). There is a delicate balance to be struck when devising problem structure for learning art, and this is part of the skills of pedagogy.

The critical elements of devising and solving problems are knowledge, experience, and the problem structure (Jonassen, 2004; Robertson, 2017). Knowledge refers to an individual's ability to understand the problem, and experience refers to one's previous encounters with the

problem area. Generally speaking, understanding a problem depends on the variables, and as the variables increase, so does the complexity of a problem. When analyzing problem structure through systems theory, problem complexity is not determined by the variables, but how they interact, which refers to characteristics such as non-linearity, self-organization, feedback loops, and emergent outcomes (Dormer & Funcke, 2017; Funcke et al, 2018). In other words, a problem can have many variables, but this does not equate to a complex systems problem.

When adopting an embodied perspective, problem-solving strategies arise from the perceived affordances of the environment and the affordances of the problem-solver. In enactive cognition, thinking is constituted in perception and action, the sensorimotor contingencies of the individual, and the situated nature of the experience. In extended cognition, when the problem-solver is coupled with the external world, those elements are constituted in cognition. In other words, perception-action cycles and elements of the external world are not causal aspects of thinking, but are constituted in thinking (Kirsh, 2009). Problems that are domain specific are situated and tied to the environment. When stating that problem-solving depends on an individual's knowledge and experience, knowledge and action are unified. The problem, the problem-solver, and the environment are entangled together which favors a dynamic systems view of thinking (Proulx & Simmt, 2016).

The ATM & problem-solving structure

Throughout this research, the elements of the artmaking system have been characterized as the essential resources needed to achieve the goal of making an artwork. These elements can be reconfigured into a problem-solving framework. For the purposes of teaching, the artmaking subject, materials, and the emerging artwork become the variables or parameters of a dynamic and complex problem-solving framework. Within this framework, the student is the artist, and their knowledge and experience should be taken into consideration when transforming content knowledge into pedagogy.

Funke et al. (2018) have outlined a means of understanding the nature of complex systems problems by describing a problem using three dimensions with varying levels of structure. These dimensions include: the available data, the awareness of methods, and the outcome criteria. Chart 11.1 is an adaptation of their work, demonstrating how the elements of the artmaking system can be organised to devise problem structures in a learning environment. The elements correspond to the following problem dimensions:

- The available information is the artmaking subject.
- The materials represent the methods for resolving the problem, or attaining the goal, and
- The emerging artwork represents the criteria for the outcomes of the process.

Chart 12.1 Problem solving Structure

	Artmaking Subject	Materials: Methods/techniques	Artwork: representational criteria	Structure
1	Visual subject: given & observable	Specified/known	Given/specified	Well-structured art problem
2	Visual subject: given & observable	Specified/known	Not given/specified	Open representational criteria allow for interpretation of the subject
3	Visual subject: given & observable	Not specified/known	Given/specified	Choice of materials: semi-structured problem
4	Visual subject: given & observable	Not specified/known	Not given/specified	Choice of materials and open representational criteria: semi-structured
5	Visual subject specified, without visuals.	Specified/known	Given/specified	Some choice in subject development: semi-structured
6	Visual subject specified, without visuals.	Not specified/known	Not given/specified	Broad areas of choice and open to interpretation: unstructured.
7	Visual subject vague or ill-defined: a theme or topic	Specified/known	Given/specified	The subject is open to interpretation, but materials and representational criteria are given: semi-structured
8	The subject is vague or ill-defined: a theme or topic	methods/techniques are not specified/known	criteria for representation are not given	No clearly articulated parameters: unstructured and open-ended problem.

When devising a problem, each element of the system can be presented somewhere along a scale of structure that varies between being well-defined or ill-defined. This is indicated in the chart by whether criteria are given, known, or open. When no criteria are given, the element (or problem parameter) becomes ill-structured and open-ended. Hence, the level of structure that is defined for the different elements will determine the complexity of the problem and if it is open-ended. It is up to a teacher to determine these dimensions when articulating the project. This point of view represents a shift away from focusing on creativity as the primary outcome of learning art and instead focuses on artistic thinking and embodied cognitive development. The next section will discuss the relationship between the problem elements (artmaking subject, materials, and artwork) and potential problem structures by drawing from the participant's artmaking demonstrations.

Materials

The materials are an element of the artmaking process and a mode of thinking. Materials and material thinking obviously can be treated together within pedagogical structuring. From a teaching perspective, teachers should consider what students could learn about material properties, methods of use, techniques of application, the relevant tools, and the potential mark-making methods. Art teachers should know and understand the fundamental affordances of the materials and the role that they play in learning how to make art. Various levels of material exploration can be undertaken with students and they can learn general or specific techniques. This would depend on the level of the learner. Materials and material processes can be the central topic of learning, or they can be integrated into the choice of an artmaking subject. In the chart, material methods and techniques are described as either given, known or left open. A given material/technique means that the material is specified. Known refers to whether the materials are familiar to the students. Not specified means that this parameter is open-ended and left up to the students to choose.

Drawing methods:

Michael used a semi-blind contour drawing as a point of departure for the painting that he made. It enabled him to position the subject on the canvas and supported the painting process. In the case of José, the drawing was also the point of departure for the artmaking process. Although he could have just uploaded the photo into the online painting software, José said that the drawing process connected him personally to the subjects, which is an articulation of his qualitative reasoning for creating the drawing. Genevieve incorporates contour drawing

and linear forms throughout her process. Her work is an example of how different material processes and methods can be used together in the creation of an artwork. These examples share two common elements: a contour drawing method and the use of an observable visual subject. It is worth noting that although each artist uses this basic drawing process for different ends, the act of observing and creating a drawing are fundamental to their processes.

Michael's demonstration illustrates that a subject can be depicted through the linear mark-making of a contour drawing versus the simplified coloured shapes that are used in his painting process. This highlights the connection between how a subject is observed (visual thinking) and how it is represented (material thinking).

Michael used a pencil, José used charcoal, and Genevieve used both charcoal and a fine brush with acrylic paint. This illustrates the versatility of drawing as a method that can incorporate a variety of materials and tools. A problem can specify a drawing method, a specific material or both. Asking students to create a linear drawing based on direct observation appears to be a relatively well-structured problem because the artmaking subject and the material method is specified. (This would be number 1 on chart 12.1.) However, how and what each individual observes, and how the subject is depicted will vary from one student to another.

Painting:

As a material parameter in a problem, paint can be framed through specific methods, techniques, use of tools and ways of making marks. When working with paint, students can learn how to paint using a direct painting method that uses strong decisive brushwork as in Michael's demonstration, or they can work with successive layers of paint, as is illustrated in the demonstrations by Mary and Genevieve. Although direct and indirect painting methods can be attained with either oil or acrylic paint, the specific techniques of paint application vary according to the medium. Teaching various painting methods will expose students to the affordances and constraints of the medium (Eisner, 2002).

Colour and paint:

Colour is a complex and key area of learning in the visual arts, and learning problems can be designed to fit anywhere along the spectrum of structure. The following are two examples based on the case studies.

Michael's painting demonstration illustrates an approach to colour that is based on direct observation and the use of tonal structures. He observes the subject and determines how to depict it based on mixing a precise hue and tone. This would be a well-structured approach to learning colour from observation that relies on analytic observational skills and analogical reasoning methods. None the less, as mentioned in previous chapters, the ability to discern the different dimensions of colour (hue, tone, saturation) is a complex reasoning process that takes time and experience to learn. In other words, although this type of learning is well-structured, it remains quite challenging.

Mary's demonstration is an illustration of how the distinct dimensions of colour can be learned and applied using both observation and imagination. Her palette of colours is restricted to analogous colours that include blues, blue-violets, greens, and yellow greens. This palette has a logical structure in which the blues and blue-violets represent the darker tones, whereas the yellow greens are used to represent light. She has selectively chosen to focus on the formal and tonal structures of her visual subjects based on her photo references, but she used colours that were not directly observed.

The pedagogical implications of this case study illustrate the complex and imaginative ways that colour can be used. As a learning exercise, students can be asked to use a black and white subject and then interpret it using a specific palette structure such as an analogous palette, a complementary palette, or a warm-cool palette. This type of learning exercise develops the ability to understand the relationship between tone and colour and how these two dimensions of colour can be treated separately. It also teaches students that direct observation of a subject is interpretive, selective, and imaginative. This example is a problem that uses a well-structured material parameter but will lead to open-ended outcomes.

Three dimensional methods with clay:

Claudine's demonstration exemplifies clay as a material process for creating three-dimensional subject matter. Her process illustrates how to systematically treat the complexity of the human portrait by using visual thinking concepts such as simplification, abstraction and synthesis. The malleable nature of the clay highlights how the materials are responsive to the touch, and the embodied dialogue that occurs between the artist and the materials. These material qualities and Claudine's working process illustrate how clay is an excellent medium for

the open-ended exploration of ideas that also requires a certain level of structure to understand how the medium functions.

Hybrid methods:

Artmaking problems obviously do not have to be limited to one specific material. Examples of hybrid methods are present in the case studies done with Genevieve and José. Genevieve incorporated contour drawing and acrylic painting in her process. José blended contour drawing from direct observation with the use of online painting software.

The emerging artwork:

The outcome of a learning problem is a form of artwork that communicates something about the artmaking subject through the materials. When designing a learning problem, the expected outcome as a final artwork can be structured by specifying various criteria that relate to the visual structure of the artwork and/or the materials. Drawing from the different case studies, the following are some examples of how artmaking problems and outcomes can be structured.

Michael: Still life painting from direct observation:

The observed subject will be rendered using broad decisive brushstrokes with a focus on simplification of the subject and elimination of unnecessary details. Colour should reflect the tonal structures that are observed. In this example of a learning problem, although certain parameters are specified, there is room for creative interpretation, making this somewhat open-ended. For example, this project calls upon the artist's personal judgements when determining what level of detail is necessary.

Mary: colour theory exercise using a choice of black and white photo:

Using an analogous colour structure of your choice, create a painting that communicates a logical relationship between light and dark tones. The choice of colour should express an emotional connection to the subject.

This example focuses on developing the visual skills of analysis of form and tone in a black and white subject and how it can be mapped onto a colour composition. Although the colour structure is articulated, the project is open-ended because it requires personal judgement

and interpretation. The project can be scaffolded with an examination of colour theory and the various applications of a limited palette. This would support visual thinking and develop skills of visual analysis and selective analogical reasoning. It can be scaffolded by demonstrations in colour mixing, which would develop material thinking. It can also be scaffolded by looking at how artists used analogous colours in their work and the expressive impact that it may have, which supports qualitative thinking.

Claudine: clay face project

Create an imaginative sculpture of a face that expresses an emotional reaction of either fear, surprise or joy. The sculpture should respect the fundamental anatomical structure of a face.

This project can be scaffolded with a study of facial anatomy, and proportions which would help develop visual thinking skills. For example, Claudine's demonstration illustrates how complex facial features begin with simple shapes that progressively integrate into a complex whole. Demonstrating the skills of adding, subtracting, and modelling clay to create a sculpture would develop material thinking. The project has a certain level of constraint but is sufficiently open-ended to enable a broad amount of personal interpretation.

The modes of thinking.

The modes of thinking reflect the embodied nature of thinking during the artmaking process. The previous examples illustrated how the modes of thinking can be integrated into the dimensions of the artmaking problem. The modes of thinking can be used to structure and scaffold learning content, and they can also be used to articulate aspects of the problem structure. Each mode of thinking can be used to classify and conceptualize the ability to communicate ideas through visual and material processes, and how to make sense of the relationship that is constructed between the elements of the artmaking system. The following example illustrates a well-structured learning problem that incorporates the artmaking system as problem parameters and how the modes of thinking can support learning criteria and outcomes.

Problem: Still-life painting in acrylic.

- Artmaking subject: visual subject is given and objectively observed.
- Materials: materials and methods are specified.

- Emerging Artwork: representational criteria are given.

Problem description: Observe the still life and paint it in a realistic style with attention paid to formal accuracy, the relationship of light and shadow and modelling of form to create a sense of depth and volume.

Visual thinking: This type of problem presents students with the challenges involved with observing and understanding the effects of light and shadow on form, how to model form to arrive at the impression of space and volume. Depicting the subject realistically could incorporate concepts such as the use of relative proportions and geometric structural lines. A realistic style leaves some room for interpretation regarding the level of rendering and compositional structure.

Material thinking concepts: The use of acrylic paint opens the possibility of teaching specific techniques to support the creation of hard or soft edges and gradations, working wet into wet painting and glazing techniques. Working with colour opens the door to observing colour and tonal relationships and understanding how to mix colours.

This type of artmaking problem can be framed through different traditions and styles known in art history, which would introduce specifications into the artwork parameter of the problem framework. For example,

- Chiaroscuro of the 17th century pushes light and shadow contrasts to extremes.
- Precisionism in the work of early American modernist painters like Charles Sheeler focuses on hard edges and tonal structures.
- Pop-art, such as in the work of Tom Wesselmann, treats forms with flat lively colours similar to commercial design and the current trends of vector art.

Another way of bringing a more open-ended parameter into this problem topic could be to introduce students to the work of Giacometti. Students could be asked to extend and distort the proportions of the observed visual shapes, allowing them greater freedom when interpreting the subject. In this case visual thinking would be more imaginative, and the qualitative nature of the problem would be augmented.

The different criteria that are described here can be used to develop pedagogical content that will scaffold learning through visual, material and qualitative modes of thinking. They can equally be used as the parameters for assessment. As the criteria become

increasingly subjective and open to interpretation, the problem becomes increasingly ill-structured. This potentially leads to individual outcomes, opening the space for imaginative and creative thinking.

A note on qualitative thinking.

Qualitative thinking reflects the experience and motivation of the artist, how and why they choose their subject matter, and how it is ultimately communicated. Any artmaking subject, no matter how simple or lofty it may be, is understood and interpreted through the lens of the individual who is creating it. There is always some level of personal and affective connection between the maker, the subject and the material.

A teacher can choose whether or not to focus on these connections by emphasizing the expressive potentials of an artmaking subject. In either case, the teacher should be aware that the qualitative nature of thinking is always present in the work that students create. Because the qualitative nature of thinking can be elusive, it can be fostered through reflective writing to build connections between embodied thinking and verbal thinking. This in turn, supports assessment. Articulating the connection between motivation, interest, goals and challenges will support how students are able to talk about their work, how they make sense of the visual, material and qualitative dimensions of their work, and how their ability to construct meaning.

Summary:

By examining the ATM through the perspective of problem-solving theory, this chapter has proposed that ATM can be used as a problem-solving framework to support the design and development of teaching curricula for artmaking. In the visual arts, artmaking problems are process oriented, and the outcomes of the problem-solving process can be considered as goals rather than solutions. The students are embedded within an environment that they interact with to arrive at their goals. In the artmaking process, the elements of the artmaking system are the essential resources for making a work of art. When designing learning situations, these elements become the variable parameters of the process, and they provide information and structure for the goals of the process. The elements of the artmaking system, as problem parameters, are used to define the dimensions of an artmaking problem along the progressive spectrum of structure. The problem-solving chart demonstrates that any element of the system, when described as a problem dimension, can have a varying level of structure which would be articulated when a project is framed and described as a problem. The modes of thinking can be used to flush out the criteria of the problem and assist a teacher in scaffolding learning

concepts. Breaking a problem down using the ATM could also assist a teacher in devising assessment criteria. The modes of thinking could be used to assess how the parameters of the artmaking problem (the artmaking subject, the materials and the emergent artwork) are realized.

The ATM offers educators a flexible, integrated framework for designing learning content that reflects the dynamic and embodied nature of studio practice. Rather than prescribing a fixed sequence of skills or techniques, the model emphasizes three interrelated modes of embodied cognition: visual thinking, material thinking, and qualitative thinking, each of which highlights a different aspect of how artistic thinking unfolds through artmaking. Ultimately, the Artistic Thinking Model supports lesson planning that can be both structured and open-ended, enabling teachers to scaffold student learning without constraining emergent meaning-making.

Chapter 13: Conclusions

This research began with Howard Gardner's (1983) speculations about a "conspiracy of silence" among artists regarding the intense cognitive demands of their work. This insight served as a point of departure for investigating what Efland (2002) described as the problematic relationship between art and cognition that has been historically overlooked, fragmented, or tacitly inaccessible. Through this research, I sought to further break down the barriers that separate the cognitive dimensions of thinking and artmaking by offering a new way of conceptualizing them.

The literature review revealed that although significant efforts have been made to recognize artistic forms of thinking, through figures such as Arthur Efland (2002), Elliot Eisner (2002), Howard Gardner (1989, 2006) himself, and the Studio Thinking framework (Hetland et al, 2015), these efforts have not been synthesized into a unified understanding of how mind, body, and material interact dynamically in the artmaking process. The analysis of art school pedagogy offered a glimpse into how traditional studio education has at times perpetuated outdated assumptions about creativity as a mysterious, ineffable talent, rather than a complex, trainable cognitive process. The phenomenon of deskilling has further complicated this picture by challenging the very notion of whether skill and cognition are integral to artistic production, thereby contributing to further distancing art and cognition from material engagement. By examining these movements and tensions, this research identified a gap: the need for a model that does not separate technique from thought, or material engagement from mental processes.

This research set out to deepen the understanding of artistic thinking by integrating theories of embodied cognition and Material Engagement Theory into the study of artmaking processes. Building on my earlier development of the Artistic Thinking Model (Marinkovic, 2011, 2021), the research explored how artistic cognition emerges through dynamic interactions between the brain, body, materials, and the environment. The study proposed a revised model of artistic thinking that situates visual, material, and qualitative thinking as complementary and reciprocal processes within a dynamic artmaking system. Each element of the system: the artist, the artmaking subject, the materials, and the emerging artwork, contributes affordances that shape and guide the evolving artwork. Through participant research with professional artist-teachers and analysis of specific artmaking processes, the ATM was refined into a flexible

framework for understanding how embodied cognition operates in the studio context. In doing so, the research offers a model not only for analyzing artistic thinking but also for developing pedagogical content that supports studio-based education.

The proposed Artistic Thinking Model offers an embodied account of artistic thinking, one that foregrounds how perception, action, and reflection co-evolve in the making of art. The central argument advanced here is that thinking in artmaking is not a linear, internal process but one that is embodied, situated, and dynamically engaged with the world, where meaning arises through cycles of perception, action, and material transformation. Rather than framing cognition as a disembodied abstract phenomenon, the ATM presents it as enacted and visible through the artist's dialogue with materials, gestures, and lived experiences.

One of the significant contributions of this research is demonstrating how material affordances, extended cognition, and enactive sense-making can be systematically integrated into the analysis of artmaking practices (Malafouris, 2013). The model offers a practical tool for artists, educators, and researchers to conceptualize artistic thinking as a dynamic, embodied system rather than a disembodied application of internalized knowledge. Furthermore, the articulation of qualitative thinking as a mode of embodied sense-making expands the understanding of how emotions, context, and experience infuse the material process of meaning making through art.

Recognizing the cognitive dimensions of artmaking is not merely an academic exercise; it carries profound implications for how art education might be reimagined. If artistic thinking is understood as an embodied, dynamic process, then pedagogy must shift to support not only technical training but also the cultivation of perceptual sensitivity, material fluency, and reflective awareness. It invites a vision of studio education that is neither purely technical nor purely conceptual but integrative, responsive, and grounded in lived experience.

While the Studio Thinking Framework (Hetland et al, 2015) has been widely adopted for its accessible structure and ability to articulate cognitive habits in art education, it ultimately reflects a classical cognitive model that prioritizes modularity, teachable dispositions, and linear progression. In contrast, the Artistic Thinking Model developed in this research offers a re-conceptualization of artistic thinking as a dynamic, embodied, and materially entangled process. Where Studio Thinking abstracts cognition into discrete skills, such as envisioning, observing, or reflecting, the Artistic Thinking Model foregrounds the recursive interplay of visual, material, and

qualitative thinking, each emerging through engagement with the evolving artwork. By integrating principles from embodied cognition and dynamic systems theory, the model frames artmaking not as a linear task to be completed, but as a self-organizing system in which meaning and understanding arise through action-perception cycles, material feedback, and the situated intentions of the artist. In doing so, it challenges the notion that artistic thinking can be standardized or decontextualized, offering instead a model grounded in the lived realities of studio practice and artistic pedagogy.

Like all research, this study has limitations. While the focus on embodied processes provides a rich and situated view of artistic cognition, the study is limited by the scope of participants and contexts analyzed. Future research could expand this work by applying the ATM to a wider range of artistic disciplines, educational settings, or longitudinal studies of artistic development over time. For example, a pragmatic application could explore ways that the ATM can inform teacher training in art education through practice-based research that combines creation and curriculum design. The ATM can be further studied as a means of developing various levels of problem structure that foster the development of artistic thinking skills and creative thinking. As a problem-solving framework, it can also be used to develop distinct forms of learning assessment.

Despite the limited scope of the research, the findings affirm the necessity of rethinking artistic cognition beyond traditional mentalist models. They point toward a future where art education and research more fully recognize the embodied, emergent, and materially grounded nature of artistic thought and practice. It is my hope that the Artistic Thinking Model, as refined here, will offer a valuable tool for supporting the reflective practice of artists, informing studio pedagogy, and enriching the growing conversation around embodiment, materiality, and creativity.

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Annex 1: Certificate for Ethical research

Concordia certificate for ethical research



CERTIFICATION OF ETHICAL ACCEPTABILITY FOR RESEARCH INVOLVING HUMAN SUBJECTS

Name of Applicant: Branka Marinkovic
Department: Faculty of Fine Arts\Art Education
Agency: N/A
Title of Project: The Artistic Thinking Model: Tacit Knowledge and Embodied Cognition in Artmaking
Certification Number: 30015220

Valid From: July 12, 2022 To: July 11, 2023

The members of the University Human Research Ethics Committee have examined the application for a grant to support the above-named project, and consider the experimental procedures, as outlined by the applicant, to be acceptable on ethical grounds for research involving human subjects.

A handwritten signature in black ink, appearing to be "David Waddington", with a long horizontal line extending to the right.

Dr. David Waddington, Vice-Chair, University Human Research Ethics Committee



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Dr. David Waddington, Chair, University Human Research Ethics Committee

Annex 2 Participant ethics form



INFORMATION AND CONSENT FORM

Study Title: The Artistic Thinking Model: Tacit Knowledge and Embodied Cognition in Artmaking

Researcher: Branka Marinkovic

Researcher's Contact Information: bmf.art@gmail.com

Faculty Supervisor: Dr. Richard Lachapelle

Faculty Supervisor's Contact Information: richard.lachapelle@concordia.ca

You are being invited to participate in the research study mentioned above. This form provides information about what participating would mean. Please read it carefully before deciding if you want to participate or not. If there is anything you do not understand, or if you want more information, please ask the researcher.

A. PURPOSE

The purpose of the research is to study the relationship between artistic practice and teaching, and to develop a teaching framework. The framework is designed to facilitate the creation of teaching content in art education. The activities in the research will focus on your artistic process and your teaching practice as an example for the field of art education. Your experience in the field will be called upon to assess how the framework can function.

B. PROCEDURES

If you participate, we will meet via the online platform Zoom on four separate occasions to do the following activities:

1. An initial interview to discuss your artistic practice, your teaching practice, and your educational background.

2. An artmaking demonstration. The activity will record, in real time, your artmaking process for a maximum duration of two hours. After the process, I will ask questions regarding your use of materials and what types of abilities are needed to achieve the process. Alternatively, if you have an artmaking demonstration available, I will ask to look at it and then we can discuss it.

3. Assessing the teaching framework: Based on your artmaking demonstration, we will discuss the teaching framework and you will be asked to create a plan for teaching that follows the framework.

4. Follow-up Interview: We discuss and clarify my understanding of your artmaking process as it pertains to the research and I will ask you to evaluate the teaching framework.

In total, participating in this study will take 8 – 10 hours.

C. RISKS AND BENEFITS

Participating in this research has no intention of posing any personal risks.

The potential benefits include learning about a new theory for teaching art that you will be free to use in your teaching practice.

D. CONFIDENTIALITY

I will gather the following information as part of this research:

- Demographic information
- Audio recordings of interviews
- Photos of your art and video recordings your artmaking process.

I intend to publish the results of this research. Please indicate below whether you accept to be identified in the publications:

☐ I accept that my name and the information I provide appear in publications of the results of the research.

☐ Please do not publish my name as part of the results of the research.

The information that you provide through this study will be retained and stored on an external hard drive that is password protected. It will not be freely accessible to anybody without my express approval. After the study is completed, it will be archived indefinitely. If you object to this, it will be destroyed after a period of ten years.

F. CONDITIONS OF PARTICIPATION

- You do not have to participate in this research. It is purely your decision. If you choose to participate, you are free to stop at any point in time. Your ongoing participation will be verified at the beginning of each research activity, to ensure that you freely consent to continue.
- If you choose to stop participating in the study, you have the right to ask that your information be discarded. After the fourth research activity, the study will be finished, and your information will not be discarded. However, if following the fourth activity, there are extenuating circumstances that compel you to believe that your information should not be included in the study, we can discuss this and determine how much information should be discarded. Once the research report or dissertation is written, it will no longer be possible to withdraw your information.

As a compensatory indemnity for participating in this research, you will receive a gift certificate for 30\$. If you withdraw before the first interview you will not receive any compensation.

To make sure that research money is being spent properly, auditors from Concordia or outside will have access to a coded list of participants. It will not be possible to identify you from this list.

There are no negative consequences for not participating, stopping in the middle, or asking us not to use your information.

G. PARTICIPANT'S DECLARATION

I have read and understood this form. I have had the chance to ask questions and any questions have been answered. I agree to participate in this research under the conditions described.

NAME (please print)

SIGNATURE

DATE

☐ Please destroy any data relevant to my participation after ten years.

If you have questions about the scientific or scholarly aspects of this research, please contact the researcher. Their contact information is on page 1. You may also contact their faculty supervisor.

If you have concerns about ethical issues in this research, please contact the Manager, Research Ethics, Concordia University, 514.848.2424 ex. 7481 or oor.ethics@concordia.ca.

Annex 3: Interview Questions

Activity 1: Initial Interview Questions:

Art education background.

- Where did you study the visual arts?
- Did you finish a BFA, year and school?
- MFA, year, and school. year and school
- Do you have a degree in art education?
- Have you received and formal instruction in education or art education?

What did you value the most in your artistic education?

- The least?
- What did you feel was missing?
- Which teachers or instructors did you appreciate most when learning art? Why?
- Have you learned aspects of artmaking informally? (through learning on your own, through books or workshops)

Artistic Practice and Art Concepts.

- What type of artwork do you make? (painting, printmaking, sculpture, etc.)
- Do you exhibit your work or have you ever exhibited your work?
- Do you have an ongoing artistic practice? How often do you make art, or how many artworks do you make in a month or in a year?
- What is the subject that your work revolves around?
- Can you describe some of the themes of your artwork?
- How would you describe the role of your work? To communicate ideas, personal experiences, political, didactic?

Materials of practice:

- What material or materials that you work the most with?
- How important are material techniques to your work?
- What materials, methods or techniques do you consistently use in your work?
- Would you say that you have a mastery of the materials? Please describe what this means to you as an artist.

- How has your practice changed since going to art school?
- Do you work with the same materials?
- Have you learned other materials? How? Why?
- Has the main subject of your work changed much? If so how?

Teaching practice.

- How long have you been teaching?
- Where do you teach?
- Who are your students?
- What made you decide to go into teaching?
- When you started teaching,
- Did your educational experience prepare you for developing your teaching practice?
- What did you use to guide you in developing your teaching curriculum?
- Is there a mentor/teacher from your artistic training that has inspired or guided you? What do you draw from them?
- What subjects do you teach?
- Do you choose the subjects or are they part of a planned curriculum?

Teaching methods:

- Do you develop a course plan? A plan for each class?
- Could you show me a lesson or course plan?
- If not, what guides your teaching when you are in class?
- What are the sources of information that you use to plan a class?
- Could you describe your teaching method? For example, what happens during the class?
- Are your teaching methods like those you learned as a student? Please elaborate how, or if not, what you do differently.

Teaching Motivation: In teaching practice, what values are present.

- What aspect of art making do you teach the most in your studio classes?
- Creativity,
- Technique,

- Personal expression and development,
- Thematic content,
- Observational abilities,
- Anything else?

How do you conceptualize teaching? Would you describe it as it problem-solving, inquiry into a subject?

Can you give me an example of this? For example, if it is problem solving, how is this done?

- Technique: what type of techniques do you teach most often.
- Personal Expression: Can you give me an example of personal expression from one of your classes?
- How much time do you spend teaching how the materials work?
- Do you relate the materials to the lessons that you are giving? Example?
- Do you ever teach methods of seeing or observing?
- Could you offer some examples?
- Do you think that this is an important part of learning art?

Relationship of Artistic Practice and Teaching practice

Would you describe the relationship of teaching and artmaking as separate practices?

- What is the separation between them? Why?
- If not, how are they united? Is there a dialogue between teaching and artmaking?

What aspects of your artistic practice are part of your teaching practice? For example, the materials and techniques you use, your approach to subjects, etc.

- What aspects of your artistic practice are not part of the way that you teach? Why?
- Are there aspects of your artistic practice that you feel are too difficult or complex to teach? Why?
- How does teaching enhance your artistic practice?

Research Activity 2: Artmaking Demonstration:

These are the pre-demonstration and post-demonstration questions used to guide the discussion. The questions focus on the process, the material skills, observational skills and the expressive or communicative intent of the artwork.

1. Problem definition:
 - What is the aim of the artwork demonstration?
 - What is being demonstrated?
 - what is the subject?
2. What is the stage of the artmaking process?
3. Problem organization and sequencing:
 - Can the participant describe the central problems or challenges in the process?
 - What was the most challenging aspect of the process?
4. Resource allocation:
 - Other than the materials, what external elements are used to support the process? (photos, drawings, etc.)
 - What material techniques or methods are used?
5. Evaluation: How does the participant evaluate the process as a whole and the individual sequences?

Post-Demonstration Interview

Visual thinking

- Describe some ways that you are intentionally directing your visual attention when creating this subject. What are you looking at and why?
- What types of observational materials do you use to support the artmaking process?
- Can you describe the ways that you use visual analysis in the artmaking process that would be pertinent for students to know and apply?

Material Thinking

- What materials are used for the demonstration?
- What can make this material difficult to work with? (2 or three properties)
- What tools or other supports are needed to use the materials (for this demonstration)

- Describe the method that you used for working with the material? Method refers to the general process and not specific techniques.
- What specific techniques associated with this method did you use in the demonstration?

Qualitative Thinking

- What is the expressive intention of this artwork?
- Do you feel that you succeeded in communicating this idea?
- Do you find that the work is creative? In what way?
- The following questions will explore how the artmaking process communicated the expressive purpose.

Is the expressive intention based on the choice of subject, how the subject is visually interpreted or in the use of the materials or all of these Please describe.

- How are emotions used in the creation of the artwork?
- Are your personal experiences important to the subject matter and the way that you have depicted it? Please describe in a way that you are comfortable with revealing.

Meaning construction:

- What does the artwork represent with regards to the subject of the work.
- What does it mean?
- Is it a narrative, an analogy, a symbolic representation, a metaphor?
- How is the meaning described?
- What is the relationship between visual form and the materials?

Annex 4: Demonstration Analysis Example

Visual thinking:	Material Thinking:	Qualitative thinking:
Where is visual focus targeted? How is it related to the problem? How is it related to the materials? Visual analysis: How is visual analysis demonstrated?	Affordances of the materials: How do the properties of the material affect the process? What material method (strategy)? Techniques?	- What is the global feeling/mood/ expressive intention that guides the process? What are the qualities of the subject that are essential to the process? - Are there features that are emphasized, ignored or minimized? - How is this expressed through visual thinking (visual structures or compositional choices)? • How is this expressed through material choices and actions? (Material properties, methods, techniques)

1. Mass of the skull	
	
1. general shape of skull: - created by paddling the mass of clay The paddling action creates the general planes of the head, thereby becoming the underlying foundation for the process.	Focal knowledge: planes of head. Subsidiary knowledge: General shape of skull as flat frontal and side planes with rounded back. Knowledge of skull anatomy and geometric simplification

2. indentation for eye sockets



Visual thinking:

problem: initial feature placement begins with eye sockets

visual focus: Symmetry of facial structure.

Material Thinking:

Affordances, techniques of the materials:
The clay is wet and thus very malleable.
The eye sockets are created pushing down on clay, making an indentation.

Pushing clay down displaces it towards the centre, lifting it up to create the bridge of the nose.

One gesture creates the basic structure of the face.

Qualitative thinking:

The first features to be created are the eye sockets. The clay is pushed in with the thumbs to mark the placement and indentation of the eye sockets. This action raises the clay between the sockets to initialize the bridge of the nose. Visually the eye sockets and initial nose bridge are projected onto 'head' structure. The gesture of pushing the clay anchors the visualisation onto the material

Focal Knowledge:

initial placement of facial features begins with eye sockets

Subsidiary Knowledge:

Proportional placement of eyes on head structure: Distance from top of head and distance between eyes
Pressure used to create indentations

3. Problem: Creating the nose shape & integrating it onto face



Visual Thinking

clay piece is formed into triangular wedge

- proportions, shape
- internal knowledge of anatomy and 3D shapes is projected and anchored onto clay piece

Material thinking:

- A piece of clay is squeezed in the hands and then is formed as a rectangular wedge.
- It is positioned to verify the size and placement, then scored and slipped.
- Using pushing gestures, the nose shape is integrated into the skull mass.
- Pushing gestures are also used to further shape the nose.

Qualitative Thinking

- emphasis is on general 3D form of nose
- notice curvature making geometric shape more biomorphic
- detailing of nose is ignored (nostrils)
- clay is smoothed to integrate it into facial structure
- .value on regular proportions (normative anatomical structure)

Process: embodied gestures, score and slip. Integrating clay piece to mass structure.

Internal knowledge of facial structure: 3d form of nose, shape, proportions and placement is projected onto piece of clay.

Anchoring: the visualised nose is anchored onto clay - note the preliminary placement to verify before integrating form onto face.

Focal Knowledge: Placement of nose

Subsidiary knowledge:

- process logic of facial construction.
- Forming basic shape to represent nose.

4. Nasolabial field: The area between the nose and mouth is added



Visual Thinking:

- nasolabial structure is projected onto face as a strip of clay.

This creates the structure of the upper lip.

- attention is given to the thickness of the clay and the angle. The strip of clay angles out from base of nose to upper lip

Material Thinking:

A piece of clay rolled and flattened, the face, beneath the nose, is scored and slipped to prepare for the clay addition.

- The width, length of clay strip is important.
- The clay strip is gently pushed down under the nose. The other side of the clay creates a ridge that becomes the upper lip.

It is pushed down at nose base, to angle outwards to prepare for upper lip structure.

Qualitative thinking

- emphasis is on progressive 3D structure
- smooth surface leading to a naturalistic appearance
- choices focus on major anatomical features as they would realistically appear.

VT- emerging facial structure - nasolabial structure is projected onto clay that is manipulated into a rectangular shape.

MT - The shape anchors this visualisation, and it is physically anchored through material thinking

Focal knowledge: upper lip structure

Subsidiary knowledge: Upper lip structure (nasolabial field); Slant of upper lip; Integration of clay through pushing and smoothing gestures to create a specific form.

5. Upper and lower lip structure



Visual thinking:

- The visual focus and analysis alternates between the portrait and piece of clay that is formed to create the lower lip,
- Visual attention focused on the size of clay, and its dimensions.
- The angle of the clay: it projects outwards from upper lip.

Visual thinking is focused on structure of mouth leading to projection onto clay. this leads to material manipulation and embodied gestures that anchor it onto the face.



Material Thinking:

A strip of clay is scored and slipped and added below the upper lip. The soft quality of the wet clay makes it difficult to carve.

- The clay representing the lower lip is pushed down onto the facial mass.
- A wooden tool scores the clay to emphasize the separation between the lips.
- Embodied movements: clay techniques of slip, score, pushing clay, smoothing to integrate it into the mass
- Scoring clay is a physical -material gesture that creates a mark



Qualitative Thinking:

- The construction of the mouth lends expressive qualities to the facial structure.
- In this case, the closed mouth has little expression, but the portrait begins to become more lifelike.

Focal Knowledge: Lower lip placement, proportions

Subsidiary knowledge:

- knowing how to prepare clay into a strip,
- understanding three-dimensional form of mouth: Lower lip angle projects outwards from mouth line
- hands movements of pressing down clay to articulate form
- Articulated lip separation with wooden tool.

6. Chin Construction



Visual Thinking:

- Problem: three-dimensional mass of head structure
- Visual focus: chin area
- Visual analysis: relative facial proportions, length of brow to nose to chin.

Material Thinking:

Affordances of the materials:

Chin structure

- The area below the mouth is scored and a rounded piece of clay is added to create the chin structure.
- The additional clay is pinched and pushed down, integrating it into the mass.
- The chin structure is enlarged on the lower part of the skull.

Qualitative Thinking:

By adding clay to the chin area, Claudine is working towards relatively natural facial proportions

Visual thinking: Visual assessment of artwork, modification of structure based on facial proportions by adding clay to add structure of chin.

Imaginative projection onto materials by taking clay, forming it, gestures of scoring, slipping, pushing clay into lower face. These gestures and material modifications anchor visualisations onto emerging artwork.

7. Cheek



Visual Thinking:

Problem: adding mass to facial structure.

Visual focus: Cheek bones
is visual focus selective: relationship of features to mass structure

Visual analysis: mass form of face, the need for additional clay

Visual analysis of facial structure leads to decision to add mass to cheekbone structure.

This is projected through the manipulation of clay pieces then anchored through embodied actions of scoring, slipping, smoothing.

Material Thinking:

Affordances of the materials:

Cheek

- The side of the face is modelled by pushing and smoothing the clay with the thumbs
- Small pieces of clay are added by pushing into the main skull to further structure the cheek area.
- Cheek folds are scored into the clay with wooden tool
- The same gesture is repeated for right side of face.

Qualitative Thinking:

- The three-dimensional structure of the face is refined by increasing mass in cheek area.
- The whole structure is observed, and changes are made.
- Clay is smoothed, reinforcing a natural quality to face.

8. Eye placement



Visual thinking:

Problem: modelling and refining eye structure: eyeball & lid

Visual focus is on volumetric structure of eyes.

Visual analysis: three-dimensional structuring of eye adding clay to create upper, lower eye lids

Material Thinking:

Eye placement

- Small piece of clay is added for eye structure.
- The clay is pushed in, then modelled with a wooden tool.
- The same gestures are repeated with the right eye.

MT: clay is formed(rolling) and placed (pushed)

Qualitative Thinking:

natural features and dimensions

Symmetry verification for ears



Visual thinking:

- Visual focus is on the horizontal symmetry of the eyes

Material Thinking:

- Using the knife to gauge the horizontal symmetry of the eyes
- This determines the placement of the ears

Qualitative Thinking:

These are embodied actions to observe and verify the symmetry of the eyes.

The knife is a straight edge to measure the upper eye lids. Claudine also looked at it from a lower angle.

Focal knowledge: Ear placement

Subsidiary Knowledge: Understanding the relational proportions of the facial features and how to ascertain them for a three-dimensional form.

9, Modelling of Clay to Create Ear



Visual thinking:

Goal: Addition of ears

Visual focus:

- on clay shapes and modelling of form to integrate ear shape to head.
- proportions, placement, dimension, depth

Visual analysis: Placement of ear shape depends on facial and head structure

VT: observing head proportions

Material Thinking:

Ear placement

- A piece of clay was rolled in the hands, then flattened and formed into a semicircular shape.
- It was positioned to verify the size. Note the angle of observation to verify the placement. It was scored and slipped then positioned.
- Pushing and pulling gestures were used to integrate the ear shape into the skull mass.
- The same gesture was repeated on the right side of the head.

MT: piece of clay that is shaped and modelled.

Qualitative Thinking:

The three-dimensional modelling of ear using rounded edges that project over flat oval shape of ear point towards a desire to create naturalistic representation.

Visualization: the shape of the ear is visualized as an oval shape

Projection of internal knowledge of ear structure onto clay

Anchoring: Modelled piece of clay is anchored onto head through embodied clay gestures and close observation of relative features of face and head size that have been created.