ISSN 1828-5961

Teaching Environmental Representation through Cognitive and Restorative Perspectives: Integrating Attention Restoration and Graphical Thinking

Today's architectural schools operate in an accelerating world of visual stimuli that has placed drawing within the realm of performance and created cognitive overload and diminished depth of attention. The intention of this study is to determine how we might be able to teach representation of the environment as cognitive and restorative practice by incorporating graphical thinking with Attention Restoration Theory (ART). One of the key components of ART is its identification of four contributing components for restoring attention; however, little has been understood regarding how these components are relevant to representational pedagogy. Using a qualitative, theory informed pedagogical approach, this study uses drawing-based learning activities in an architectural studio to operationalize these four components through two sequential tasks. Through analyses of student work, short reflections, and studio observations, this study concludes that drawing based upon restorative principles supports students in exhibiting sustained attention and an increase in perceptual awareness and reflective engagement. Finally, the study suggests that these findings provide a human-centric basis for reviewing the graphical sciences and environmental representations within visually stimulating educational environments.

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Keywords:
Architectural Education; Attention Restoration Theory (ART); Environmental Representation; Graphical Sciences; Graphical Thinking

DOI: https://doi.org/10.20365/disegnarecon.36.2026.16

ISSN 1828-5961

1. INTRODUCTION

Today's architectural education is influenced by the speed of visual information resulting from widespread use of digital tools, real-time rendering, parametric modelling, and continuous production of images in academic settings [1-3]. While these new tools have extended our ability to represent graphics; they have also created a crisis of attention by diminishing our ability to sustain visual perception, engage in reflective observation and engage with environment's complex nature and lead to a decline in the quality of drawings to produce high-speed and low-effort images [4-6]. The increasing pace of graphic representation poses serious challenges for the graphic sciences because, drawing has been used as a means of cognitive processing by Architect's to develop their understanding of space through attention regulation, perception exploration and spatial reasoning [7, 8]. In addition, research in cognitive science and environmental psychology highlight the limitations of using directed attention under high-load conditions and have led to the development of Attention Restoration Theory (ART) as a framework for understanding how we deplete attentional resource and restore them via our exposure to environment [9]. ART describes the types of environmental conditions that can lead to the restoration of attentional capacity but the contributions that ART may make to the representational practices and graphic pedagogy within architectural education has been little studied. This paper contends that we can influence the future of the graphic sciences by integrating ART into graphic thinking, by reframing the representation of the environment so that it is not a visual or technical output but rather a restorative cognitive framework through which drawing can help to restore attention, provide depth of perception, and encourage periods of cognitive engagement [4, 9, 10]. By conceptualising representation as both cognitive and restorative, this study aims to restore the human element of drawing to the digitalized academic learning environment and provide a theoretical framework to move representation pedagogies away from visual efficiency to support periods of cognitive engagement, depth of perception and an understanding of the Environmental context.

2.LITERATURE REVIEW

2.1 DRAWING AS COGNITIVE AND CULTURAL PRACTICE IN GRAPHICAL SCIENCES

Historically, drawing has played an important role in graphical sciences as a tool for analysis, interpretation, and synthesis. Drawing has also been a cognitive tool used to externalize thought, enabling designers to perceive, ask, and reassemble the world around them where visual expression is closely connected with perception; perception with reason; and through visual exploration, knowledge is created [4, 7]. However, with the rise of the digital paradigm, this relationship has changed. The dominance of computing power and automated visualization has moved the focus away from the process of drawing to the final product, resulting in a shift from drawing being a creative process to being a routine task that is technical in nature and diminishes the capability of drawing to stimulate critical observation and reflective thinking [2, 11]. In this way, experiences with representation from a disciplinary perspective have been impoverished, and ability to interpret visually has been diminished by criterion driven performance. To reframe drawing as a cognitive and cultural practice, we must consider again how visual experience shapes the way we perceive things, as well as how we pay attention to them. Graphical thinking, as defined in design theory, describes drawing as an active form of inquiry rather than a passive act of representation; thus, designers create meaning through drawing, test hypotheses, and develop an embodied understanding of the spatial and environmental world in which they live [8, 10]. This perspective is consistent with the goals of graphical sciences to address current visual challenges through technology by incorporating cognitive principles in a way that brings back the human element of representation. Through the use of drawing, designers create a mediation between the observer and the environment that serves to counteract the fragmentation of visual stimuli [5].

2.2 REPRESENTATION LITERACY AND COGNITIVE VISUAL PROCESSES IN ARCHITECTURAL DESIGN EDUCATION

Since the beginning of architectural education, representation (both graphic and verbal) has been an important part of architectural education. Representation has historically been used as a way of communicating ideas but more importantly, representation provides the basis for how architect's think through, perceive, organize, and understand what they see, as well as the space around them; and thus provides a foundation for architectural thinking and learning. In architectural education, architects rely on graphical representation through drawings, diagrams, etc., as cognitive aids and as tools for iterative reasoning, revealing: Developing, Changing & Testing their ideas through a visually explorative process [4, 8, 12, 13]. This has come to be understood within architectural pedagogical dialogue as "representation literacy"; meaning more than technical competence and representational accuracy in the use of drawings, diagrams, etc., but as a means of reading, interpreting, producing, and thinking through graphical representation; therefore also as a means of defining disciplinary knowledge [14, 15]. Research within the fields of cognitive science and design studies shows how visual thinking aids in architectural problem solving by providing externalized representations of complex spatial relationships; thereby reducing cognitive load on designers, enabling them to judge design alternatives, represent revised drawings for ill-defined conditions, and participate in reflective discussion between the perception of drawings and design action [16-18]. However, the current architectural study program is situated primarily within accelerated and digitally driven workflows dominated by automated design practices through parametric modeling, real-time rendering, and automation of visualization, which places more emphasis on the speed and accuracy of visual production rather

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ISSN 1828-5961

than on exploratory reasoning [19]. When representation literacy is framed within these workflows, representation literacy becomes viewed merely as software competency and not as an ongoing and continually developing, perceptual and cognitive process; and therefore students become visually productive but cognitively blind [5]. Consequently, recent pedagogical discourse calls for the re-centering of graphical education in a cognitive model based upon creating a temporal and experiential learning process of drawing that helps develop awareness of how students' attention, perception, and experience of the body develop through drawing as opposed to being viewed only as a static endpoint or representation [5, 15]. Therefore, when framed in this way, representation literacy provides a connection between graphical science and fundamental questions regarding the way designers think the way they perceive, which will provide educators with a basis for integrating and responding to the attentional challenges faced by students engaged in visually accelerated learning environments by integrating cognitive with restorative approaches.

2.3 ATTENTION RESTORATION THEORY (ART) AS A FRAMEWORK FOR VISUAL ANALYSIS

According to ART, attention can be understood as a finite, dynamic cognitive resource that can be depleted and restored, influenced by experiences [9, 20]. Originally created to address the restoration effect of both the natural built environments, ART has been used to explore cognitive abilities, perception and activity engagement when an individual is experiencing attentional fatigue within mediated and representational contexts [21-23]. ART consists of four related components: being away, fascination, extent and compatibility. Together these components help define situations that support attention restoration [9]. Being away refers to having a psychological distance from performance and evaluative demands so that one can shift towards exploratory and perceptual engagement, thus supporting cognitive flexibility and recovery. Fascination refers to naturally engaging one's attention, without expending energy, by the perceptual qualities of a stimulus such as pattern, texture, rhythm and atmosphere which allow for attention to be held without continued depletion of attention [24, 25]. Extent relates to the continuity of experience; when two or more representations are perceived to be coherent and sufficiently represented, an individual is likely to continue to explore and to further map out the cognitive area represented [9]. Compatibility focuses on how well the intentions, abilities and requirements of an individual fit together and support an activity; agency and cognitive fit are important in maintaining substantive attentional engagement [26, 27]. These four components illustrate how ART can help understand visual analysis and representational practice as processes shaped by attention, perception and cognitive engagement instead of merely extracting information from representations. When ART is applied to graphical/visual practices, it changes the emphasis of these practices from efficiency and density of data to the extent that they allow for the depth of perception, duration of attention and recovery to an individual experiencing attentional fatigue, thus providing a theoretical framework for integrating restorative principles into architecture education and representation.

2.4 COMBINING ART AND GRAPHICAL THINKING

Newer studies on how architecture is taught are claiming that drawing must reconnect its use as part of reasoning and perception rather than visual production techniques. Drawing, through graphical thought processes, can be used both as a cognitive tool as well as an act of creation [4, 12]. Similarly, through ART, graphical thought processes can be seen to restore attention. ART sees that an individual's attention is limited and influenced by their experiences of being away; therefore, fascination or the amount of attention that they acquire; extent of being fully engaged with an activity; and how closely the prior experiences of an individual match their current experience through ART [9, 20]. When we combine these two concepts together, drawing becomes an experiential system for regulating engagement and attention as both an expression and reflection of the individual's cognition, externalizing their thoughts as a result of drawing and how this externalization creates an experience to reduce attentional fatigue through mechanisms of perceptually distant from the activity; easily engaging with the activity; maintaining a constant visual perception of the activity; and the activity matching the individual's mental state [9, 13, 27, 28]. This results in creating the experience of being away by eliminating evaluative performance; developing fascination based on physical characteristics of the representation such as texture and rhythm [24, 29]. creating extent through multiple representational layers which supports a cohesive responsive exploration [9]. and matching representation and learning ability [26]. Therefore, the integration of ART and graphical thought processes creates a system of representation that creates a dual cognitive and restorative experience, most directly highlighting drawing as a humanistic activity that develops the recovery of attention and reflective thinking.

Integrating art and graphic thinking in architecture education has recast the way we represent our environment, seeing drawing as both a mental and healing activity and a pedagogical tool to aid attention, perception and long-term involvement in graphics science.

DOI: https://doi.org/10.20365/disegnarecon.36.2026.16

ISSN 1828-5961

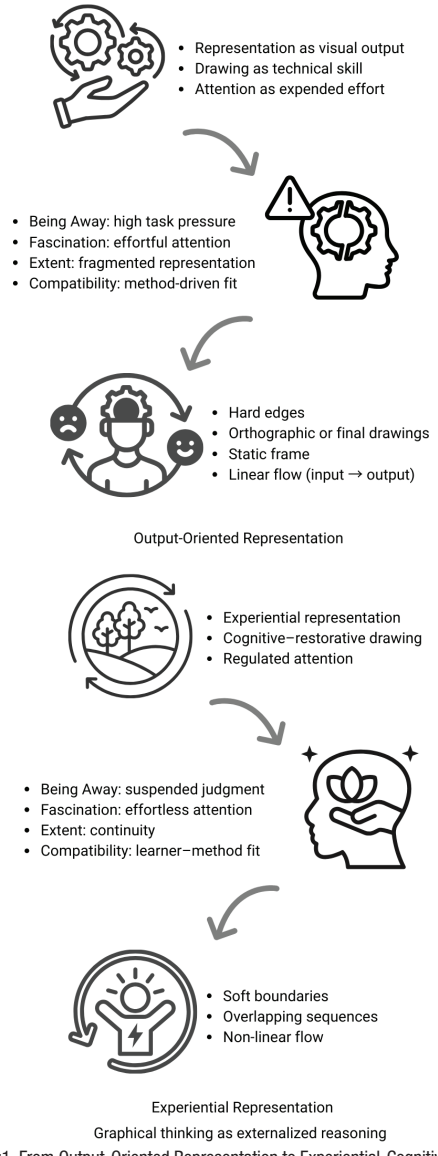

Fig1. From Output-Oriented Representation to Experiential-Cognitive Representation.

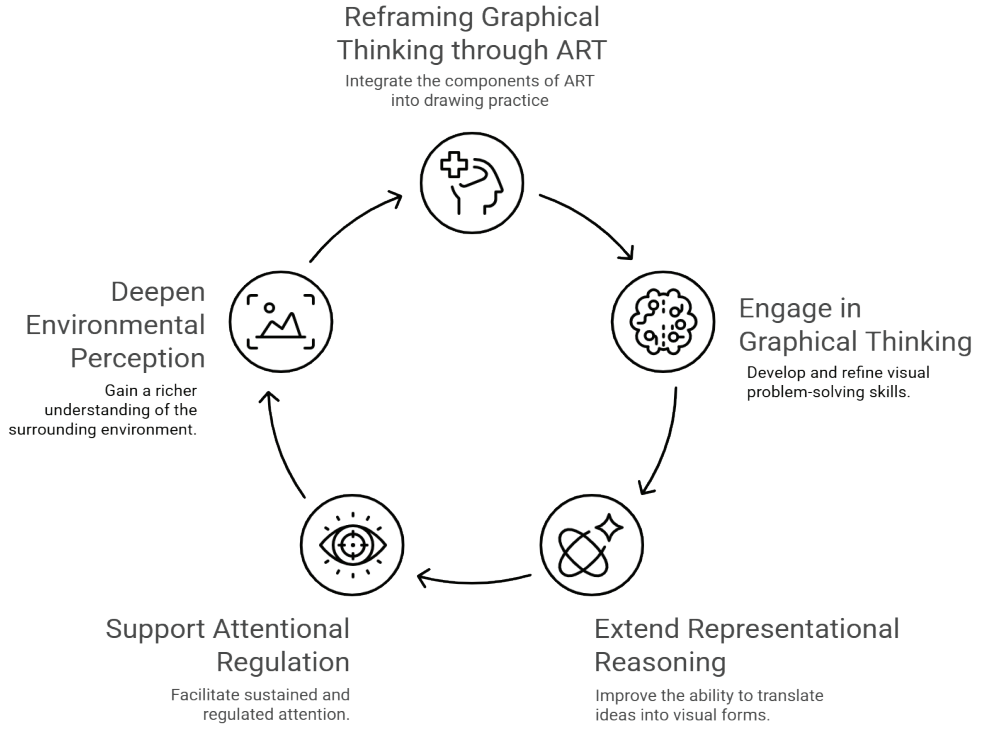

Fig2. Conceptual framework of restorative drawing in architectural education

3. METHODOLOGY

An approach to analysis of how to teach environmental representation as both a cognitive and restorative process in architecture education was used within this research study; the intention, however, was not to quantify aspects of attentional restoration through measuring the amount of attention restored from drawing related activities, but rather explore how drawing related activities establish the conditions for ART (attention-restoring techniques) and how these conditions affect the way that architectural students represent what they experience in their environments. The framework used for conducting this research study was a studio-based traditional pedagogy that included experiential, visual, and reflective components of learning.

3.1 RESEARCH APPROACH

The study is a pedagogical exploration that is exploratory in nature through theoretical synthesis. Graphical thinking and architecture have been used as conceptual and analytical frameworks that help Phase I through both activity design and outcome interpretation. This approach is consistent with architectural education research tra-

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ditions, which consider drawing, observing, and reflecting valid ways to investigate; the focus is on process and not measurable outcomes.

3.2 Educational Context

The study was done as part of Architectural Design 3, a second-year undergraduate course for 90 architecture students at Rajamangala University of Technology Thanyaburi, Thailand, which included practical experience in the landscape area of the Faculty of Architecture. Drawing was incorporated into the curriculum as part of the first phase of studying the site before formal analysis and building design on that site. By incorporating drawing into the course, a direct examination of representation (drawing as a means of communicating ideas) could happen in an authentic educational atmosphere, without creating a separate experimental environment.

3.3 LEARNING ACTIVITY DESIGN

Environmental representation as a cognitive and restorative approach was the primary pedagogical intervention. This practice fused graphic thinking with the four components of ART through two consecutive site-specific drawing assignments. The first assignment focused on perceptual connections and expanded attention. As students created drawings of elements that captured their attention, they were not concerned with representational accuracy or evaluation; rather, they were drawn to create because their attention was captured by the light, texture, shadow and motion around them that activated their attention by decreasing performance pressure (being away) and fascination (effortless engagement with environmental properties).The second assignment (Continuity and Personal Representation) had students create a drawing of the same site from an experiential continuity (rather than isolated objects), representational basis, creating a sequence, a transition from one point to another in space, or telling a story of what happened to create a series of events to be represented in a drawing. With respect to extent, students were able to represent their experience using cohesive experiential fields; also, they created their drawings using personal, self-selected, methods through which to express themselves (compatibility) based on their preferences and cognitive styles. Each of the drawing assignments lasted about 30 minutes, conducted in two consecutive sessions on the same day, providing enough time to experience without creating performance-related fatigue.

3.4 DATA COLLECTION

The qualitative, experiential materials that were collected throughout the study included students' drawings created by students for both tasks; written reflections on their attention and representation choices, collected as open-ended, handwritten responses immediately following each drawing session; and observational notes recorded by the researcher during studio sessions while observing students as they engaged in the activity. Students' drawings were analyzed as visual representations or records of the processes of perception and cognition.

3.5 ANALYTICAL FRAMEWORK

The data analysis utilized ART as an interpretative lens to examine the students' drawings, reflections and observed behaviors as they relate to the components of ART. Analysis followed a deductive thematic approach, with being away, fascination, extent, and compatibility, serving as predetermined criteria against which patterns in the data were identified by the researcher and verified by an expert reviewer. Students' behaviors exhibited being away through reduced evaluative concern, increased exploratory engagement; fascinated by attending to environmental qualities that sustained their interest through no effort; extended by continuity, layering, or narrative structure in representations; and compatible with explanations as to how drawing approaches were consistent with their ways of seeing and thinking. Rather than using frequency or statistical comparisons, the analysis was to identify recurring patterns that demonstrated how representational practices functioned as cognitive and restorative processes in the learning environment.

4. RESEARCH FINDINGS

The following findings are drawn from students' engagement with the two drawing tasks and subsequent reflections.

4.1 PERCEPTUAL ENGAGEMENT AND ATTENTIONAL FOCUS

Students' responses to the first drawing task showed a perceptual response to the environment based on elements that appeared to attract attention as opposed to representational accuracy or pre-defined objects. They consistently referred to atmospheric and sensory characteristics of the elements with regard to light and shadow, movement and rhythm, reflections in water and the movement of leaves or branches by the wind, as well as to texture or material properties (e.g. tree bark, foliage, stone, brick, and how they were weathered). Many students also compared the texture or material properties of natural elements to those of artificial elements. Most students described their attentional experience as consistent, relaxed and clear mentally, providing a steady and without effort focus. Although there were external disturbances (e.g. noise and time limitations), students were able to selectively sustain focus on specific sensory features. Overall, the task opened a gateway for students to engage in a non-linear, exploratory manner by focusing on immediate perceptual qualities (e.g. light, movement, texture, ambience).

DOI: https://doi.org/10.20365/disegnarecon.36.2026.16

ISSN 1828-5961

Fig3. Drawings Exploring Environmental Attention

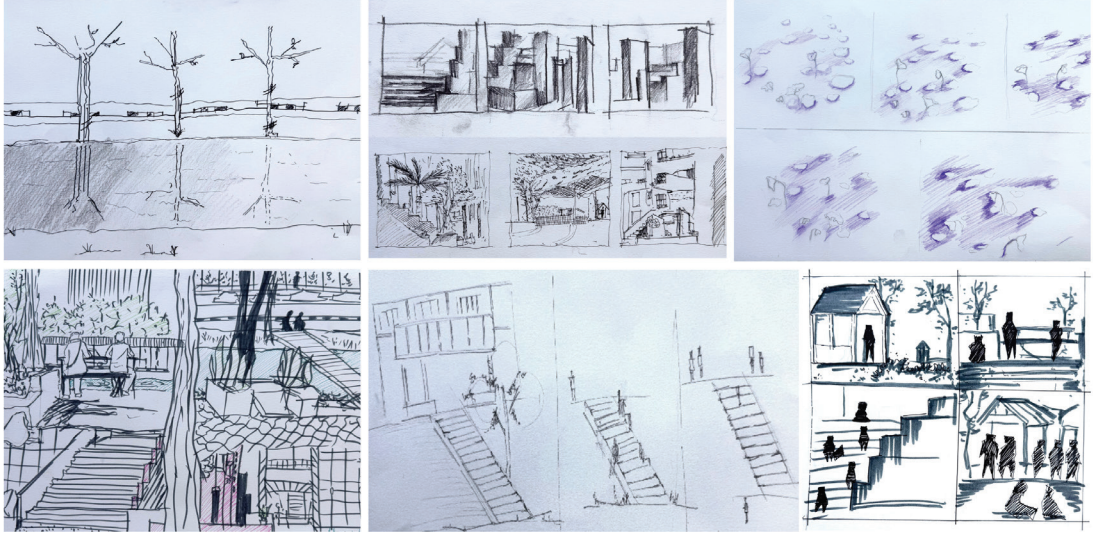

Fig4. Drawings Exploring Continuity Through Representation

4.2 PERCEIVING CONTINUITY AND WORKING THROUGH DRAWING

In the second drawing assignment, students viewed the site as a whole system rather than individual elements. They described continuity of movement, rhythm, and gradual changes both spatially and over time, including the movement of wind, water ripples, where trees are located in relation to one another, light, shadows, and the patterns of where people walk. Many noted changes that happen over time, such as seasonal changes or how a tree grows up and becomes decayed. These observations reflect how they understand the site as continually changing. In addition, they used drawings to represent their ideas and thinking, by intentionally using line, layering, repeated elements, tonal differences, and sequences to depict flow, transitions, and stories. As a result, drawing was a way for the students to develop and express how their ideas relate spatially and to show continuity through the way they drew the site. Overall, this drawing task allowed the students to engage in multiple ways, where their methods of representation fit with how they perceive and think about the site.

4.3 FROM ATTENTIONAL ENGAGEMENT TO DESIGN-ORIENTED UNDERSTANDING

In summary, students' responses indicate that they engaged in both drawing experiences through a process of learning that progressed from perceptual engagement to design-oriented understanding. The first drawing facilitated an attentional breadth, which provided an opportunity for students to disengage from performance issues and focus on the qualities of the environment (light, movement, texture, sound & atmosphere). Then, through the second drawing, students were able to organize their perceptions of the environment into coherent representations through the manipulation of continuity, spatial relationships, temporal change, and narrative flow using methods consistent with each individual's way of seeing & thought. Reflectively,

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this progression allowed for development of site characteristic knowledge such as tree presence, shading patterns, air movement, water reflection, sound gradients, and spatial uses to be transformed into architectural intentions including facade systems, circulation, spatial sequencing, passive environmental controls, and programmatic organization. Rather than forming an imposition of concepts, students appeared to derive their ideas directly from the drawing process, suggesting that attentional engagement and representational continuity functioned together as a cognitive and restorative process that bridged the two modes of perception and early stage architectural thinking. The graphical sciences have a new perspective: integrating being away and fascination involves representing teaching as a reflective process rather than a technical exercise, restoring focus and enhancing perception. The re-conceptualization of drawing emphasizes that drawing is a cognitive (and, therefore, human centric) activity that connects environmental psychology and architectural education, while anticipating methods for visual learning within the rapidly changing technological environment.

5. DISCUSSION

Based on the findings, the two-part drawing activity acted as a unified pedagogical process where attention conditions and representation practices influenced both site understanding and design thinking by the students. The initial drawing provided the students with an open attentional experience by suspending the performance evaluation component and promoting engagement through perception with the environmental characteristics of light, movement, texture, sound, and atmosphere. The second drawing organized the students' perception while creating coherent representations through established connections (spatial relationships), changes in time and narrative, and through methods aligned with their personal values and beliefs. Progression indicates that being away and being fascinated allowed for depth of perception and then validation through observation and correlation to develop meaningful spatial knowledge. Importantly, insights from design were developed through the act of drawing and not through abstract representation, which highlights that representation serves an intermediary role between environmental perception and architectural reasoning. In terms of ART, the results suggest that restorative conditions can be embedded into representational pedagogy and illustrate that drawing serves both as a cognitive and attentional task. In terms of graphical sciences, this redefines representation as a human-centered system based upon attention depth, perceptual coherence, and meaning-making, and establishes graphical thought and ART as complementary frameworks in architectural education.

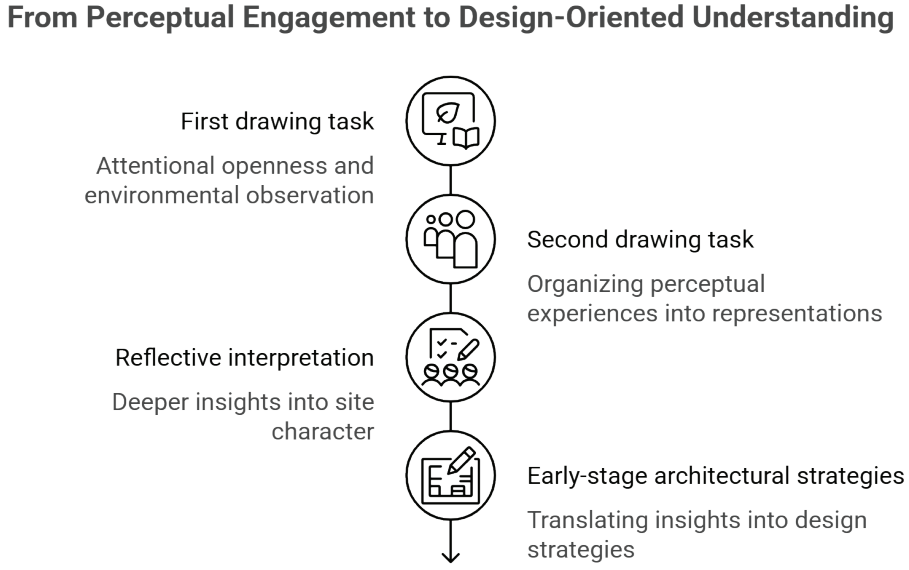

Fig5. Developmental progression from perceptual engagement to design-oriented understanding

6. IMPLICATIONS FOR ARCHITECTURAL EDUCATION AND GRAPHICAL PEDAGOGY

The results of this study propose that the way architecture is taught could improve if we rethink how we teach drawing. Instead of teaching drawing as a skill-based performance, we could teach it as a human-centered practice. To achieve this, we need to incorporate activities into studio courses that promote being perceptually open, having experiential continuity and allowing for an individual's agency. This helps students develop the capacity to maintain strong focus, develop contextual and experiential depth about the environment they are designing for, and engage in reflective practice prior to using analysis and producing work digitally. By doing so, students will begin to think of sites as complex systems that are dynamic and relational; they will develop spatial literacy from issues related to sight, sound, and experience instead of only from issues related to software. When we incorporate restorative principles into how we teach drawing, it reinforces that

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observational and reflective drawing processes complement fast-paced digital drawing processes. Together these types of drawings will help educators to re-evaluate graphical pedagogies to value depth of attention, coherence between perception and cognition, and meaningful engagement in visually rich environments.

7. FUTURE RESEARCH LINES IN VISUAL ANALYSIS

Visual analysis research in the future should also include ways in which attentional states as well as representing practices work together in different educational contexts and types of media. This study's qualitative, process-based approach should lead to future studies investigating restorative principles of a hybrid analog-digital environment and if digitally mediated representation can provide equivalent attentional/perceptual effects. Qualitative/mixed-methods approaches (i.e., longitudinal studies, reflective visual diaries, etc.) may also be used to record the time-based and experiential aspects of drawing processes. Lastly, collaborative efforts between graphical sciences, environmental psychology, and cognitive science will help refine conceptual/methodological tools that will aid in understanding how visual representations influence attention, perception, and meaning-making within visually accelerated learning environments.

8. CONCLUSIONS: GRAPHICAL SCIENCES AND THE NEAR TOMORROW

Considering a rapidly increasing rate of visual acceleration and cognitive overloads, many graphical sciences face increasing pressure to rethink representation's role as something other than just a technical efficient process of producing another form of visual output. This research has demonstrated how drawing can be reframed within architectural education through the combined use and understanding of Attention Restoration Theory and graphical thought. Specifically, developing drawing based activities to encourage an experience of attentional openness, perceptual continuity, and autonomy will allow designers to use representation as a vehicle for restoring attentional depth, developing the perceptual awareness, and developing the ability to construct meaningful spatial understanding. As we move towards the future, there is an opportunity for graphical sciences to redefine representation as a human-centered field of study bringing together technology, cognition, and the experience of the environment, ensuring that visual practices will not only continue to be productive but, also continue to be perceptually and cognitively sustainable in the rapidly changing environments of educational systems.

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