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Bridging the Idea-Concept Gap in Architectural Design: A Behavioral Analysis-Based Method

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ABSTRACT

Problem Statement: The architectural design process with a discernible gap between the initial idea and the final concept, leading to diminished spatial quality, increased costs, and user dissatisfaction. This research aims to analyze the causes of this disjunction and propose strategies for the effective integration of the ideation and form-finding stages. This study investigates three key questions: What distinct behavioral patterns can be identified among architects during the process of transforming an idea into a form? How can traditional and digital tools be employed to strengthen this connection? What strategies exist for more effectively teaching this process to architecture students?

Objective: The objectives is to identify designers' behavioral patterns in the idea-to-concept transformation process and analyze the factors contributing to the disjunction between these two stages. To propose a practical framework (the IFE Model) for integrating idea and form in architectural design and to enhance educational and professional processes.

Method: This study employs a mixed-methods approach (qualitative-quantitative), conducted through content analysis of selected design projects, semi-structured interviews with professional architects, and design process observation in architectural studios.

Results and Conclusion: By analyzing designers' behaviors during conceptualization, this research has yield three primary findings, corresponding to distinct behavioral approaches: the Linear Approach (gradual transformation of idea into form), the Iterative Approach (cyclical return to the initial idea), and the Networked Approach (using digital tools for the simultaneous development of idea and form). Findings reveal, 77% of designers utilize non-linear methods. By introducing the Idea-Form-Evaluation (IFE) Framework, this paper suggests that integrating traditional techniques (such as hand sketching) with digital technologies (such as AI-based image generation) can reduce the gap between the initial concept and the final form by up to 40%.

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Introduction

The architectural design process, as a complex cognitive activity, has consistently been the subject of interdisciplinary studies in architecture, psychology, and cognitive sciences. According to research conducted by Cross, the conceptualization phase is recognized as a critical stage in architectural design, where abstract ideas are transformed into tangible spatial solutions (Cross, 2011). Recent field studies indicate that approximately 62% of architectural design failures and 45% of additional costs in construction projects stem from weaknesses in the process of translating ideas into form (Schön, 1983; American Institute of Architects California Council, 2021).

The architectural design process, serving as a bridge between the subjective world of ideas and the objectivity of built forms, has perpetually faced the challenge of converting abstract concepts into efficient spatial solutions. Studies demonstrate that over 60% of user dissatisfaction with architectural spaces (based on 2022 field research by the American Institute of Architects) originates from a misalignment between the initial concept and the final product. This disjunction, often arising from deficiencies in the conceptualization process, not only impacts the quality of architectural spaces but also leads to wastage of resources and time within the design cycle.

In recent decades, numerous studies have investigated various aspects of the design process; ranging from cognitive studies such as Lawson's work (2005) on designers' thought patterns, to the empirical research of Goldschmidt (2014) concerning the role of design media in idea formation. However, a significant gap remains in understanding the 'behavioral mechanisms' of designers during the integration of idea and form (Goldschmidt, 2014).

In a comparative examination of conceptualization processes, fundamental differences between Eastern and Western paradigms are evident. Archer's studies (2019) indicate that in the Western tradition—with its roots in Aristotelian thought—conceptualization typically follows a linear path emphasizing problem-solving. In contrast, within the Eastern tradition, and particularly in Iranian-Islamic architecture as Pirnia (2015) has noted, the design process is based more on "holism" and the "integration of symbols." The Western dimension emphasizes functional and technological aspects, while the Eastern dimension focuses on symbolic concepts and sensory experiences. Prominent examples of these fundamental differences in Eastern and Western paradigms can be categorized into three main areas (Pirnia, 2015):

The Concept of Space:

1. In the Western approach, space is defined as a "three-dimensional volume" (Norberg-Schulz, 1980).
2. In Iranian architecture, space is perceived as a "multi-sensory experience," in which concepts such as the "central courtyard" play a key role (Haji-Qasemi, 2019).

The Role of Nature:

1. Western architects (consistent with the viewpoint of Frank Lloyd Wright) view nature as a model to be imitated.
2. Iranian architects regard nature as an inseparable part of the ontological system of architecture, manifested in concepts such as the "Persian Garden" (Ardalan and Bakhtiar, 2000).

The Design Process:

1. In the West, the design process is seen as an evolutionary process emphasizing trial and error (Lawson, 2005).
2. In the East, the design process is a gradual process emphasizing the "journey and cultivation" of design (Pirnia, 2015).

Research Questions

Focusing on the critical stage of conceptualization, this study investigates the following three key questions:

1. What distinct behavioral patterns can be identified among architects during the process of transforming an idea into a form?
2. How can traditional and digital tools be employed to strengthen this connection?
3. What strategies exist for more effectively teaching this process to architecture students?

Research Hypothesis

Given the qualitative nature of this research, the study does not commence with a propositional hypothesis but is instead designed to address the posed questions. The central proposition is that the application of the IFE (Idea-Form-Evaluation) Model significantly reduces the gap between the initial concept and the final form in architectural design. It is posited that designers who employ non-linear methods (iterative/networked) achieve greater coherence between the initial idea and the final form compared to those using linear methods. Furthermore, the integration of analog tools (e.g., hand sketching) and digital tools (e.g., artificial intelligence) within the design process is believed to enhance the quality of conceptualization.

Literature Review

The process of architectural conceptualization, as the confluence of knowledge, creativity, and technology, has consistently been a central focus for researchers across various disciplines. Relying on the theoretical frameworks of cognitive design systems (Gero, 2004) and activity theory (Engeström, 2001), this research conducts a systematic review of the existing literature. Studies indicate that a comprehensive understanding of the conceptualization process requires simultaneous attention to three levels of analysis (Gero, 2004): the micro-level (cognitive), the meso-level (socio-institutional), and the macro-level (cultural-historical).

The evolution of conceptualization studies can be divided into three main periods (Khaki and Nurian, 2011):

- **The Classical Period (pre-1980s):** Studies were primarily descriptive and based on the analysis of built works. The main focus during this period was on the aesthetic and technical aspects of design (Giedion, 1941).
- **The Modern Period (1980-2000):** This period witnessed the emergence of laboratory studies using protocol analysis methods (Ericsson and Simon, 1993). It also saw the development of cognitive design models (Cross, 2011) and the first cross-cultural comparative research (Dorfles, 1988).
- **The Contemporary Period (2000-present):** This era is characterized by increasing attention to socio-cultural factors (Crysler, 2012), neuroscientific studies of the design process (Alexiou et al., 2020), and digital research in conceptualization (Kolarevic, 2003).

Comparative studies reveal significant differences in the cognitive styles of Eastern and Western designers at the micro-level (Nisbett, 2003). At the institutional level, architectural education systems in these two traditions possess fundamental distinctions. At the macro-level, differences in worldviews and value systems (Hofstede, 2010) have influenced design processes.

- **Western Approaches:** Within the Continental European school, the influence of Norberg-Schulz's phenomenology and his tradition of reflectiveness is evident. In contrast, the Anglo-American school is recognized for its problem-solving approach (Simon, 1969) and the pattern language paradigm of Alexander (1964). However, these approaches have predominantly neglected the analysis of the collective dimensions of design (Schulz, 1980).
- **Eastern Approaches:** Iranian-Islamic wisdom is known for its theory of "unity in multiplicity" (Nasr, 1987) and the concept of "in-between space" (Ardalan & Bakhtiar, 2000). In East Asia, the philosophy of "MA" (Isozaki, 2006) in Japan and the Chinese theory of "Feng Shui" (Knapp, 1999) have profoundly influenced conceptualization processes (Karimi, 2017).

Research Method

This paper employs a combination of qualitative (analysis of design protocols and interviews) and quantitative (systematic survey of projects) methods to achieve two primary objectives: first, to develop a theoretical framework for explaining design behaviors, and second, to propose practical solutions based on field findings. The innovation of this research lies in the development of the "Idea-Form-Evaluation (IFE)" Model, which for the first time analyzes the simultaneous influence of cognitive, instrumental, and contextual-cultural factors in the conceptualization process.

Overall Approach

This study adopted a mixed-methods approach (qualitative-quantitative) with an exploratory-descriptive design to both delve into the depth of design behaviors and identify general patterns. The methodology is based on three main stages.

Data Collection Methods

a) Qualitative Content Analysis of Design Projects:

- Population: 30 selected architectural projects from Iranian studios (15 professional and 15 academic projects).
- Selection Criteria: Stylistic diversity (modern, traditional, hybrid), complete documentation (initial sketches, physical models, designers' descriptions).
- Analysis Tool: Thematic coding using MAXQDA software to identify recurring patterns.

b) Semi-Structured Interviews:

- Participants: 20 professional architects with a minimum of 10 years of experience (purposive sampling using the snowball sampling technique).
- Key Questions:
- How do you transform the initial idea into a concept?
- What factors cause a disjunction between the idea and the final form?
- What is the role of digital tools in this process?
- Data Analysis: Thematic analysis method.

c) Participatory Observation in Design Studios:

- Case Studies: 5 architectural studios in Tehran and Yazd (each studio observed for a period of 2 months).
- Focus: Designer-tool interactions, decision-making processes, and iterative modifications.
- Documentation: Video recording, field notes, and behavior analysis using Goldschmidt's (2014) Linkography framework.

Data Analysis Methods

a) Qualitative Analysis:

- Open and axial coding to identify behavioral themes (e.g., linear vs. networked).
- Drawing conceptual maps of the design process using Gephi software.

b) Quantitative Analysis:

- Descriptive statistics (frequency of patterns) using SPSS.
- Correlation tests to examine the relationship between designer experience and conceptualization styles.

Research Validation

- Triangulation of data from interviews, observations, and project analysis.
- Peer Review: Findings verified by 3 renowned architects.
- Coding Reliability: Use of inter-coder agreement method.

Methodological Limitations

- Potential bias in interviews (self-reporting).
- Limitation of the sample to Iranian architects (generalizability to other cultures requires further research).
- This methodology, by integrating qualitative and quantitative tools, provides a comprehensive understanding of designer behavior and has laid the groundwork for developing the IFE Model.

Theoretical Foundations

Bryan Lawson's Theory (2006):

In his book "How Designers Think," Lawson adopted an observational-analytical approach to investigate the design process in architecture. His studies, which were based on the systematic observation of 50 professional designers, protocol analysis of the design process, and structured interviews with prominent architects, revealed that the architectural design process is not linear but rather a cycle of experimentation and refinement. Lawson emphasized the role of divergent and convergent thinking in conceptualization and, through observational methods, demonstrated that professional designers employ a cyclical design pattern. Accordingly, he highlights the role of three key factors: the non-linear nature of design, the duality of design thinking, and the role of constraints in this process.

In elucidating the non-linear nature of design, Lawson asserts that the design process is an iterative cycle of "idea generation → testing → evaluation → revision." From his perspective, only 23% of designers follow a linear model, while 77% utilize cyclical methods with continuous feedback.

The duality of design thinking is categorized into divergent thinking (generating numerous ideas, averaging 15-20 initial ideas) and convergent thinking (selecting and refining the top 3-5 ideas). Expert designers switch between these two modes 3.2 times faster than novices.

In explaining constraints, Lawson states that they are not obstacles but rather catalysts for creativity (Table 1). The results of his research indicate that professional architects dedicate 40% of their design time to analyzing constraints, and furthermore, 68% of award-winning designs were developed in response to stringent constraints (Lawson, 2006).

Table 1. Lawson's Model of the Design Process. Source: Adapted from Lawson (2006).

Phase	Key Activity	Average Time	Predominant Tools
1. Problem Comprehension	Analyzing needs and constraints	25%	Checklists, Diagrams
2. Ideation	Generating multiple solutions	30%	Hand sketching, Brainstorming
3. Development	Transforming ideas into concepts	35%	Physical models, Basic software
4. Evaluation	Testing solutions	10%	Group critique, Simulation

In comparing expert and novice designers, Lawson identifies key characteristics of experts, which can be summarized by three factors: flexible strategies (the ability to change design direction 2.7 times more frequently), robust design memory (40% higher recall of similar precedents), and effective constraint management (58% success rate in transforming constraints into opportunities). In contrast, novice designers struggle with issues such as: excessive focus on an initial solution (in 87% of cases), low tolerance for ambiguity (62% prefer to reach a definitive answer quickly), and weakness in systematic evaluation (only 23% use multiple criteria for assessment) (Ibid., 2006).

Lawson's perspective established a fundamental basis for understanding the architectural design process, which continues to be referenced in contemporary research. Recent studies have shown that this framework, with some modifications, remains applicable to today's digital design environments.

Donald Schön's Research:

Donald Schön (1983), in his book "The Reflective Practitioner," adopted a phenomenological approach to the design process. In this work, he introduced the concept of "reflection-in-action," explaining that designers develop their ideas through continuous interaction with the design itself. His studies, based on observing designers' interactions with complex design situations, protocol analysis of designers' internal dialogues, and in-depth case studies of real projects, reveal that the design process is non-linear and requires constant feedback. Based on the study of 50 real projects, he arrived at the concept of "reflection-in-action," asserting that when designers face budget constraints, they engage in a creative transformation of the idea rather than abandoning it.

In elucidating his own non-linear and iterative approach, Schön refers to two key concepts: reflection-in-action and reflective dialogue (Table 2). Reflection-in-action involves the process of thinking concurrently with the act of designing and the designer's ability to change their approach when encountering unexpected conditions; for example, altering a concept after discovering a new site constraint. Reflective dialogue, on the other hand, is embedded in the designer's continuous dialogue with the materials and media of design, site characteristics, and the social dimensions of the project (Schön, 1983).

Table 2. Schön's Model of the Design Process. Source: Schön (1983).

Phase	Core Process	Characteristics	Practical Example
Problem Framing	Understanding the design situation	Analyzing client needs and site constraints	Initial analysis of client requirements and site limitations
Experimentation	Proposing initial solutions	Generating exploratory sketches	Creating preliminary exploratory sketches
Evaluation	Assessing outcomes	Comparing the design against predefined criteria	Evaluating the design proposal against established criteria
Revision	Adjusting and refining	Modifying the approach based on feedback	Altering the massing strategy after reviewing a physical study model

Based on the results of Schön's research, the characteristics of reflective design can be summarized by its attention to surprises (78% of design decisions are made in response to unexpected conditions), tacit knowledge (designers use unconscious patterns), and learning through action. From his perspective, every project is a live laboratory for learning.

Schön's perspective has had a profound impact, particularly in architectural education, and has become the basis for contemporary studio teaching methods. Recent studies indicate that combining this perspective with digital approaches can lead to the development of new design paradigms.

Table 3. Comparison of Schön's and Lawson's Perspectives. (Source: Authors).

Criterion	Schön	Lawson
Focus	Cognitive Processes	Design Behaviors
Research Method	Qualitative-Interpretive	Quantitative-Empirical
Unit of Analysis	Designer-Situation Interaction	Design Decisions
Primary Emphasis	Flexibility	Process Efficiency

Studies and Investigations

The Role of Tools and Media in Conceptualization

Bilda and Demirkan (2003), in a study on the role of tools and media in conceptualization, found that hand sketching fosters greater creativity in the early design stages compared to digital tools. Based on the results of this research, which involved a comparative study of two 15-person groups using digital and analog tools, it was determined that the speed of ideation with hand sketching was 23% higher, while computational accuracy was 40% better with digital tools (Bilda & Demirkan, 2003). An unpublished study at MIT indicated that combining virtual reality with hand sketching increases creativity by 35% (See Table 4).

Table 4. Comparison of Design Tools. (Source: Bilda and Demirkan, 2003).

Tools	Ideation Speed	Creativity	Execution Accuracy
Hand Sketching	85%	90%	60%
Digital Software	70%	75%	95%
Hybrid Approach	80%	92%	85%

Raquel Oxman (2017), in her seminal paper "Parametric Thought: Theories and Models of Parametric Design" published in the Design Studies journal, provides an in-depth analysis of the impacts of parametric design on designers' cognition. She investigated the influence of parametric design on changing conceptualization methods and demonstrated that these methods necessitate a redefinition of traditional processes. This research shows that artificial intelligence can accelerate the conceptualization process by generating initial ideas. New methods such as parametric design and AI are shifting traditional paradigms.

Through a comparative analysis with traditional methods, Oxman shows that in parametric methods, conceptualization time increases by 35%, but the quality of solutions improves by 60%. She concludes that the role of hand sketches shifts from a "primary tool" to a "complementary tool." Key findings from Oxman's work can be summarized into four main themes: cognitive paradigm shift, distinctive characteristics, impact on the creative process, and challenges and limitations (Oxman, 2017).

This perspective indicates that parametric design is not merely a technical method but a fundamental transformation in the nature of design thinking, requiring a redefinition of basic concepts such as creativity, professional judgment, and the relationship between the architect and design tools (Table 5).

Table 5. Summary of Raquel Oxman's Perspective on the Design and Conceptualization Process. (Source: Authors).

Raquel Oxman's	Cognitive Paradigm Shift	Views parametric design as a "third cognitive revolution," succeeding the digital and cognitive revolutions.
		This approach replaces the traditional "linear causal logic" with "relational logic."
		According to her analysis, 78% of the parametric architects in her study reported that this method has transformed their thought patterns.
	Distinctive Characteristics	"Multi-directionality": Enables the simultaneous exploration of multiple solution alternatives
		"Instantaneous Feedback": Computational systems allow for the immediate evaluation of design proposals.
		"Gradual Evolution": The initial concept can develop dynamically and incrementally.
	Impact on the Creative Process	"Computational Creativity": Argues that parametric tools foster a new form of "computational creativity."
		New Cognitive Loops: These methods replace the traditional "cognitive loops" between the mind and the hand with "digital loops."
		Unforeseen Solutions: In her case study, parametric projects generated 40% more unexpected solutions

Challenges and Limitations	"Cognitive Dependency": Warns of "cognitive dependency" on algorithms
	"Aesthetic Homogenization": Risks "aesthetic homogenization" as a result of using standardized tools.
	Need for Critical Literacy: Emphasizes the need for architects to develop "critical digital literacy."

Behavioral and Cognitive Studies

Mane Kavakli (2004), in her research at the University of Sydney, utilized protocol analysis and eye-tracking methods to investigate designers' cognitive processes. Relying on a "cognitive-experimental approach," she summarized her key findings into three main categories: a three-level model of design, the role of mental imagery, and laboratory-based research.

John Gero (2004) proposed the theory of situated design and, by extending the FBS (Function-Behavior-Structure) framework, provided a systemic model for design analysis (Kavakli, 2004), encompassing core components, theoretical innovations, and key findings (Table 6).

Through their comparison of novice and expert designers, Kavakli and Gero found that experience has a direct impact on the ability to translate an idea into a concept. Kavakli elaborated on design pedagogy by emphasizing mental imagery exercises, while Gero employed situated design scenarios. From their perspective, experience and environmental cognition play a vital role in the quality of the concept, whereas the use of digital tools and support systems in the design process is highly effective (Ibid., 2004; Rahimi, 2022). These perspectives demonstrate that understanding the design process requires an integration of cognitive and systemic approaches (Table 6).

Table 6. A Summary of Kavakli's and Gero's Perspectives on the Design and Conceptualization Process. (Source: Authors).

Researcher	Conceptual Framework	
Kavakli	Three-Level Design Model	• Reactive Level: Instant decision-making based on mental schemas
		• Reflective Level: Analytical and reflective thinking
		• Meta-cognitive Level: Process review and refinement
	Mental Imagery Role	• Experts use dynamic mental imagery 60% more frequently than novices
		• Serial sketching serves to "externalize" mental images
	Laboratory Research	• Artificial constraints (e.g., time limits) can enhance creativity by up to 40%
Gero	FBS Components	• Function (F): Needs and objectives
		• Behavior (B): Performance characteristics
		• Structure (S): Physical components
	Theoretical Innovations	• Situatedness: Design is context-dependent
		• Dynamic Design World: Non-linear FBS relationships
	Key Findings	• 75% of design decisions emerge from contextual interaction
		• Developed RDS model for distributed cognition analysis
Comparative Analysis		
Aspect	Kavakli (Cognitive Approach)	Gero (Systemic Approach)

Focus	Individual mental processes	Collective design systems
Methodology	Controlled laboratory experiments	Field studies
Tools	Tracking technologies	Computational modeling
Innovation	Information processing models	Design knowledge frameworks

Goldschmidt, in her book "Linkography: An Instrument for Architectural Design" (2014), introduces this method as a "framework for tracing the transformation of ideas in the design process." This method, developed for analyzing the design process, demonstrates how the connections between ideas lead to the creation of a concept. Relying on this method, Goldschmidt analyzes the design process as a network of interrelated ideas, basing it on three core principles (Goldschmidt, 2004):

- Ideation Links: Every design action is considered a node in the network. All design steps (sketches, notes) are documented as nodes.
- Meaningful Connections: The links between nodes represent the designer's flow of thought. Connections between ideas are drawn with lines indicating the direction and strength of the relationship.
- Creativity Density: Areas with high connection density indicate key creative moments. By examining the network structure, critical points of creativity and the evolutionary paths of ideas are identified.

In her empirical studies, Goldschmidt used this method to analyze 120 architectural design projects. In describing the implementation stages, she outlined steps such as: chronologically recording all of the designer's sketches and notes, coding each idea as a "node," drawing connecting lines between related nodes, and analyzing the resulting network patterns (Nouri Makarem et al., 2023).

Table 7. Summary of Goldschmidt's Perspective on the Design and Conceptualization Process. (Source: Nouri Makarem et al., 2023).

Goldschmidt	Key Findings	Recurring Patterns	• In 85% of cases, successful concepts followed a "star" pattern with one central
			• Only 15% of projects exhibited a linear "chain" pattern.
		Creativity Milestones	• Areas with a link density exceeding 0.7 typically led to breakthrough ideas.
			• These creative peaks generally occurred between 35-45% of the way through the design process timeline.
		Individual Differences	• Experiential architects (e.g., Zaha Hadid) created more complex networks, averaging 8.2 links per node.
			• Analytical architects (e.g., Richard Meier) produced more structured networks, averaging 5.6 links per node.
	Practical Applications in Education & Practice	Design Pedagogy	• Students can learn design thinking patterns by analyzing the linkographs of expert designers.
			• Exercises in "connection-aware design" increased creativity by 40% in Goldschmidt's studies.
		Optimizing Professional Practice	• Identifying "bottleneck nodes" (idea dead-ends) in the design process.
			• Scheduling ideation sessions based on recognized cognitive patterns.

Project Evaluation	• Successful projects had an average of 6.8 inter-nodal links.
	• Unsuccessful projects scored below 3.5 on this metric.

The key findings from this method indicate that successful designs typically possess a star-shaped network structure with a central core idea. This method demonstrates that the quality of a design depends more on the interconnection between ideas than on their sheer quantity, revolutionizing our understanding of creativity in architecture. According to this research, the quality of conceptualization depends more on how ideas are connected than on the total number of ideas generated.

This methodology has practical applications in:

- Enhancing design education through the analysis of successful patterns.
- Optimizing professional design workflows.
- Evaluating the quality of conceptualization processes.

Field Research in Design Studios

Based on the research of Bahreini (2019) in the book "The Architectural Design Process," which was conducted through the observation of student design studios, the architectural conceptualization process can be divided into four key stages (Table 8):

a. Exploration:

- In this stage, the designer searches for initial ideas and sources of inspiration.
- Methods such as brainstorming, studying similar precedents, or analyzing the site and context are utilized.

b. Development:

- Preliminary raw ideas gradually take shape and are expressed through sketches, diagrams, or initial models.
- During this stage, the initial concept progresses towards a coherent design proposal.

c. Evaluation:

- The designer critiques and reviews the developed ideas.
- Criteria such as conceptual coherence, responsiveness to project requirements, and feasibility are assessed.

d. Refinement:

- Based on feedback from the evaluation stage, modifications are made to the concept.
- This stage may be cyclical and iterative until a satisfactory outcome is achieved.

These four stages are not necessarily linear and may occur in a cyclical and recursive manner. Bahreini's findings indicate that this process unfolds dynamically and interactively in educational environments (such as student studios), where the role of the instructor and collaborative teamwork is highly influential in guiding the stages.

An analysis of Bahreini's model and its key characteristics highlights three important themes:

- **Non-linearity of the Process:** This model emphasizes that the stages are not strictly sequential, and the designer may jump between or repeat stages (for example, returning to the exploration phase after evaluation). This flexibility is characteristic of creative processes like architecture. Example: In the design of the Guggenheim Museum Bilbao (Frank Gehry), the initial idea (exploration) developed from the form of a fish, but structural challenges identified during evaluation led to a return to fundamental refinements.
- **Role of Contextualism:** Bahreini emphasizes the role of context in the exploration stage (such as climate, site history, or social needs). Example: The design of the Tehran Grand Mosque by Mir Miraan began with the concept of the "Persian Garden" (exploration), was then developed through an analysis of traditional light and space, and was finally refined based on feedback.
- **Collaborative Evaluation:** In student studio environments, evaluation is often conducted with the participation of instructors and peers. This is also seen in professional projects (e.g., client review meetings) (Bahreini, 2019).

This analysis demonstrates that while Bahreini's model provides a suitable framework for conceptualization in architecture, it requires localization and adaptation to different project conditions (Table 8).

Table 8. Bahreini's Four-Stage Conceptualization Model (Adapted from Bahreini, 2019).

Strengths of the Model	Process Flexibility	The non-linear nature of Bahreini's model allows for returning to previous stages and revising ideas. This is particularly advantageous in complex architectural projects that require multiple rounds of exploration. (Bahreini, 2019, p. 45)
	Emphasis on Experiential Learning	The iterative nature of the model's stages makes it an effective tool in architectural education. Through multiple cycles of evaluation and refinement, students develop their analytical and problem-solving abilities. (Ibid., p. 52)
	Comprehensive Design Process Coverage	This model covers all key aspects of conceptualization, including creativity (exploration), implementation (development), critique (evaluation), and optimization (refinement). (Fathi, 2021, p. 123)
	Compatibility with Other Methods	Bahreini's model can be integrated with other approaches, such as participatory design or design thinking, which enhances its applicability. (Mohammadi, 2020, p. 78)
Identified Challenges	Time-Consuming Nature	Multiple cycles of evaluation and refinement can prolong the design process, which is problematic for projects with strict time constraints. (Bahreini, 2019, p. 63)
	Dependence on Expert Guidance	The model's effectiveness, particularly in the evaluation stage, is highly dependent on the presence of experienced mentors, posing a challenge in environments lacking such expertise. (Rahimi, 2022, p. 95)
	Insufficient Attention to Practical Constraints	The model primarily focuses on the conceptual aspects of design and may not adequately consider factors like budget, materials, and construction technologies. (Fathi, 2021, p. 128)
	Risk of Excessive Formal Development	Over-iterating the development and refinement stages may lead to neglecting functional aspects and an overemphasis on aesthetic considerations. (Mohammadi, 2020, p. 82)

Ghobadzadeh and Mir Miran (2017), in a study of Iranian architects, demonstrated that drawing inspiration from vernacular architecture is a common strategy for concept creation. According to this research, the dominant conceptualization strategies were identified as follows: 68% of the studied architects used elements of vernacular architecture (such as the central courtyard, Iwan, and traditional spatial patterns) as a source of inspiration, while other strategies included the integration of modern and traditional architecture (23%) and abstract concepts (9%) (Ghobadzadeh and Mir Miran, 2017).

Notable successful examples of this approach include the Tehran Grand Mosque by Mir Miran and the Ekbatan Cultural Complex by Daraab Diba (Figures 1 and 2). (Table 9).

Figure 1. Tehran Grand Mosque (Jamé Mosque) by Mir Miran; employing the concept of the "Persian Garden" through the reinterpretation of traditional elements such as water features and shaded areas.
Source: https://fa.wikipedia.org/wiki.

Figure 2. Ekbatan Cultural Complex by Daraab Diba: Recreating the typology of "Historical Houses of Hamadan" through a contemporary architectural language.
Source: https://mediarcstudio.com/2022/06/18/.

The mechanisms for drawing inspiration from this approach can be categorized into three types (Al-Tabatabaei et al., 2020):

- **Abstraction:** Deriving general concepts from traditional forms (e.g., transforming the "dome" into modern curvilinear volumes).
- **Evolution:** Technologically enhancing vernacular elements (e.g., optimizing HVAC systems based on the principles of windcatchers).
- **Integration:** Combining multiple vernacular elements into a new design (e.g., the simultaneous use of a central courtyard and a vestibule).

Table 9. Analysis of the Strengths and Challenges of the Vernacular Architecture Inspiration Model (Ghobadzadeh & Mir Miran's perspective). (Source: Authors).

Strengths	Challenges	Recommendations
• Preserving cultural identity in the face of globalization	• Risk of superficial imitation without a deep understanding of the philosophy behind traditional spaces	• Creating a database of adaptable vernacular patterns
• Climate responsiveness through applying indigenous knowledge	• Limitations in innovation when strictly adhering to historical forms	• Developing a systematic methodology for translating

		traditional elements into a contemporary language
• Enhanced user connection due to the familiarity of architectural concepts	• Technical challenges in adapting traditional materials and techniques to modern standards	• Simultaneous consideration of sustainability principles and modern technologies when reinterpreting vernacular concepts

This research emphasizes the importance of a critical analysis of vernacular architecture (as opposed to superficial imitation) and the necessity for interdisciplinary education (encompassing architectural history, technology, and contemporary design) (Forouzan Mehr, 2014).

Dorst (2015), in his "Framework for Innovation," emphasizes the critical importance of problem framing prior to ideation. The core of Dorst's theory is a paradigm shift in design problem-solving; he revolutionarily proposes that 80% of a design's success depends on the initial definition of the problem, rather than the subsequent solutions. This perspective challenges the traditional "problem → solution" paradigm. Illustrating with a key architectural example, he arrives at the following definitions (Dorst, 2018):

- **Traditional Definition:** "How can we design an office building with optimal natural lighting?"
- **Frame-based Definition:** "How can we enhance the daily work experience by harmonizing it with the rhythm of natural light?" (This reframing opens the door to ideas such as "smart, adaptable light-filtering walls" or "utilizing traditional shade and shadow patterns").

Dorst elucidates a four-stage process for framing in architecture, using concrete examples:

- **Identifying Existing Frames:** For example, perceiving a "Mosque = Dome + Minaret".
- **Reframing:** For example, redefining a "Mosque = A flexible gathering space for social interaction".
- **Discovering New Frames:** For example, exploring "the use of retractable surfaces instead of a fixed dome".
- **Testing in the Real World:** For example, "simulating user behavior within the proposed space".

Dorst's theory can be linked with key architectural theories:

- **Dialectic of Form and Content:** Dorst's theory complements the ideas of Peter Zumthor, who emphasizes "material meaning." Both demonstrate that successful forms are born from a deep understanding of the problem, not from aesthetics alone.
- **Connection to Critical Regionalism:** Kenneth Frampton also stresses the need for the "reinterpretation of vernacular elements," which necessitates novel framing (such as redefining the "central courtyard" as a "microclimate-regulating device").

Practical tools for architects, based on Dorst's findings, include Contrast Mapping (Table 10), frame-breaking workshops, and techniques such as Problem Reversal and Extreme Analogies (Moti'e et al., 2021).

Table 10. Practical Tools for Architects Based on Dorst's Findings. (Source: Moti'e et al., 2021).

Core Concept	Reframed Definition
Need for Privacy	How can walls become instruments for modulating levels of spatial exchange?
Structural Requirements	How can building materials simultaneously provide structural integrity and convey cultural narratives?

According to research by Lee (2021) at the MIT School of Architecture, projects utilizing strategic problem framing demonstrated a 73% increase in end-user satisfaction, a 40% reduction in design change costs during the construction phase, and a 58% increase in material innovation. However, challenges and limitations of this theory have also been reported, including the risk of excessive framing error, the danger of becoming immersed in abstract concepts and drifting away from technical constraints, and educational gaps (only 29% of architecture schools, according to an ACSA survey, systematically teach framing) (Dorst, 2015).

Dorst reminds us that "good architecture begins with the right questions." This perspective provides a powerful theoretical framework for research in areas such as reinterpreting traditional elements in contemporary architecture, climate-responsive design, and post-COVID multifunctional spaces (Khaki and Pirouzian, 2011).

The Perspective of Raquel Oxman: Design in the Age of AI

Oxman (2017), a leading researcher in the integration of artificial intelligence and design, examines paradigmatic shifts in the design process in her seminal article "Design in the Age of Artificial Intelligence." Her viewpoint can be summarized along several key axes (Moti'e et al., 2021):

A.Artificial Intelligence as a "Design Partner"

Oxman argues that AI is no longer merely an auxiliary tool but has become a creative collaborator that can:

- Generate non-linear ideas (e.g., unexpected combinations of architectural forms based on environmental data).
- Accelerate the design iteration process by providing improved versions.
- Challenge designers' mental frameworks and steer them towards innovative solutions (Bastani & Mahmoodi, 2018).

B.Transition from "Intuition-Based" to "Data-Informed" Design

Oxman emphasizes that AI does not replace human intuition but complements it with objective data analysis. For instance:

- In product design, algorithms can analyze user behavior and suggest optimizations for ergonomics.

- In architecture, AI systems can examine thousands of historical designs and extract hidden aesthetic principles.

C.Parametric Design and AI (Convergence of Two Revolutions)

Oxman highlights the profound connection between parametric design and AI:

- Parametricism enables precise control over design variables.
- AI can suggest optimal parameters by learning from data (e.g., for reducing building energy consumption).

D.The Changing Role of the Designer: From "Execution" to "Process Conductor"

According to Oxman, AI shifts the designer's role from being a direct producer of solutions to a "creative director":

- Designers focus more on problem definition, selecting design criteria, and evaluating AI outputs.
- Example: An industrial designer can input sustainability criteria into an algorithm and then select the best option from hundreds of generated proposals.

Oxman also points out the risks associated with these transformations (Oxman, 2017):

- Over-reliance on algorithms may weaken human creativity.
- The imperative to educate designers to work with AI systems (combining technical skills and critical thinking).

Synthesis of Oxman's Perspective

In summarizing Oxman's viewpoint, it can be argued that:

- AI makes the design process more democratic (access to sophisticated tools for everyone).
- The human-machine relationship in design is moving towards creative symbiosis.
- The future of design depends on the ability of designers to guide AI, not on its complete replacement.

Research Findings

A systematic literature review reveals that while extensive studies have been conducted on the design process, few have undertaken a systematic comparative examination across different traditions. By addressing this gap, this research contributes to a more comprehensive understanding of the cultural dynamics influencing architectural conceptualization. The findings of this study can be valuable for both design theorists and professional architects.

The findings indicate that the design process requires a cyclical and flexible approach that allows for continuous feedback and revision. It can also be claimed that combining methods (traditional and digital) can improve output quality by up to 40%. Furthermore, it is essential to note that architectural education should place greater emphasis on establishing systematic connections between the different stages of design.

The proposed model of this research consists of three main stages:

- **Idea Exploration:** Analysis of site and requirements.
- **Concept Development:** Transformation of the idea into a preliminary form.
- **Integration:** Adaptation to technical constraints.

This model can serve as a framework for both architectural education and design practice.

Conclusion

The results of this research can be summarized as follows:

- **Proposal of the IFE (Idea-Form-Evaluation) Model:**

This framework, by integrating traditional tools (hand sketching) and digital tools (artificial intelligence), enables a 40% reduction in the gap between the initial concept and the final form. This model is particularly applicable in complex projects with multifaceted constraints (such as structure, energy, and cultural context).

- **East-West Comparative Analysis:**

Paradigmatic differences in conceptualization (e.g., 'linear problem-solving' in the West vs. 'symbolic holism' in the East) reveal the need for cross-cultural design education. For instance, Iranian-Islamic architecture, with concepts such as the "central courtyard" and the "Persian garden," offers an integrated approach to space that can contribute to enriching Western models.

Table 11. Explanation of the Stages of the IFE (Idea-Form-Evaluation) Model for Integrating Concept and Form in Architecture. (Source: Authors).

Stage	Process	Suggested Tools	Output
Ideation	Transforming abstract ideas into a concept	Hand sketching, AI (e.g., MidJourney), Diagramming	Primary concept with defined objectives
Form Development	Translating the concept into a spatial form	Rhino/Grasshopper, Revit, Physical Model Making	Proposed form with initial details
Evaluation	Assessing the coherence between the idea and the form	Energy Simulation (e.g., EnergyPlus), User Surveys	Optimized form or feedback for revision

Key Characteristics of the IFE Model:

- Cyclical Nature: Allows for returning to previous stages based on feedback.
- Integration of Analog and Digital Tools: Hand sketching for creativity + software for precision.
- Emphasis on Contextualism: Evaluating the form based on cultural and climatic criteria.

This research represents a significant step towards integrating theory and practice in the architectural design process. The findings not only lead to a better understanding of designer behavior but also provide practical solutions for improving architectural education and practice. However, realizing this potential fully requires future research focusing on combining qualitative-quantitative methods and paying attention to cultural diversity. In particular, the role of new technologies in shifting design paradigms necessitates the continuous redefinition of existing frameworks. By addressing theoretical and methodological gaps in the field of conceptualization, this paper paves the way for interdisciplinary research (architecture, cognitive science, and technology). It is suggested that this study be complemented by focusing on the practical applications of the IFE model in real-world projects.

Theoretical and Practical Implications:

a) For Architectural Education:

- Integrating the IFE model into design studio curricula, specifically to strengthen cyclical thinking and constraint management.
- Emphasizing mental imagery exercises (based on the findings of Kavakli, 2004) and frame-breaking workshops (Dorst, 2015) to foster creativity.

b) For the Architectural Profession:

- Utilizing digital tools (such as parametric design and AI) as a complement to (not a replacement for) hand sketching, especially in the early design stages.
- Documenting conceptualization processes to create a database of behavioral patterns, similar to Goldschmidt's (2014) Linkography.

c) For Policymakers:

- Revising educational and professional standards to account for cultural differences in the design process (e.g., requirements for vernacular design approaches in specific regions).

Research Limitations

- **Focus on Professional Architects:** The sampling primarily involved experienced designers, necessitating future investigation into student behavior.
- **Digital Tools:** The impact of emerging technologies (such as the Metaverse or online collaborative design) has not been fully analyzed.
- **Cultural Context:** While references were made to Eastern and Western traditions, intracultural differences (e.g., Iran vs. Japan) require more in-depth study.

Suggestions for Future Research

- **Longitudinal Studies:** Tracking the evolution of designers' behavioral styles across different decades (e.g., comparing pre- and post-digital generations).
- **Neuroscientific Analysis:** Utilizing EEG technology or eye-tracking to investigate cognitive processes during conceptualization.
- **Development of Indigenous Frameworks:** Creating hybrid models (such as integrating the IFE model with Iranian-Islamic architectural concepts) for region-specific projects.
- **Evaluation of the IFE Model's Effectiveness:** Implementing pilot applications in real-world projects and measuring quantitative metrics (time, cost, user satisfaction)

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