# Seeking Order in Chaos: Mahjong's Strategic Philosophy for Product Innovation Design

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**Abstract:Product design is confronted with the dual challenges of diversified user needs and accelerated technology iteration, necessitating the development of a dynamic systematic strategy. Traditional approaches, lacking integration of Eastern Game Philosophy, exhibit deficiencies in cultural cognition and systemic thinking. By adopting the core philosophy of Mahjong, "seeking order in chaos," as the conceptual foundation, this study integrates cultural semiotics and dynamic systems theory to analyze its rule-based mechanisms and adaptive decision-making processes, thereby proposing a tripartite design principle of "order-adaptability-modularity." This framework provides methodological support for solving design conflicts in complex environments through flexible adaptation within the constraints of rules and culturally grounded system construction. The research results not only establish an interdisciplinary theoretical interface for the design innovation of complex systems, but also guide design science toward shifting from passive response to active pre-construction of order, facilitating entropy reduction through design and reconstructing a sustainable innovation path that balances technical practicality with humanistic value.**

**Keywords: Seeking Order in Chaos; Mahjong Philosophy; Complex Adaptive Systems; Modularity; Entropy Reduction**

## 1. Introduction

"One billion people, nine hundred million mahjong players, and one hundred millionobservers," this folk saying, despite its playful tone, vividly highlights the profound mass foundation of mahjong in China [1] . Mahjong tile symbols, such as the dragon representing prosperity and the character tile embodying balance, not only encapsulate the concept of harmony in Eastern culture but also encapsulate the concept of harmony in Eastern culture but also foster collaboration and resilience through family and community engagement. The core of its game mechanism—"seeking order in chaos"—reveals the capacity to construct ordered strategies through dynamic decision-making in randomized scenarios. This process integrates logical reasoning, psychological tactics, and social interactions, aligning profoundly with the complex challenges in contemporary product design, such as fragmented user demands and uncertainties driven by rapid technological iterations.

"Oriental Wisdom," as a sustainable development concept rooted in historical foresight and knowledge, deeply interprets the deeper connotation of the "horizon" in design practice. Within the framework of global value chain, addressing the industrial upgrading requirements of intelligent manufacturing and the transformation challenge of industrial clusters, Oriental Wisdom establishes the foundation for creating the paradigm of "Oriental Intelligent Manufacturing" via the synergistic logic of systematized integration and elastic adaptation [2] . However, existing design theories have inadequately explored the order-generating logic of Oriental gaming wisdom, particularly concerning the integration of cultural cognition and systemic thinking. Based on this, this study translates the rule topology and dynamic decision-making mechanism of mahjong into the design principle of "order-adaptability-modularity", aiming to compensate for the limitations of the traditional paradigm through interdisciplinary approaches. It seeks to elevate design practice from passive response to active pre-construction of order, thereby providing culturally grounded solutions for innovation in complex environments.

 

## 2. Basic Elements and Rules of Mahjong

### 2.1 Composition of Mahjong

Mahjong, as a strategic game with an oriental philosophy, features a system of rules and symbols that collectively create a dynamic balance of "order emerging from chaos." The tabletop game is a card game that has evolved over thousands of years, eventually settling into a standardized method of play. A standard mahjong set consists of 144 tiles divided into five categories: the *Characters, Bamboos, and Dots* (numbered suits, each comprising 9 distinct numerical types with 4 identical tiles per type, totaling 108 tiles), *Wind tiles* (East, South, West, and North, 4 tiles each), and *Arrow tiles* (Red, Green, and White, symbolizing "Zhong," "Fa," and "Bai" respectively, 4 tiles each)[3] . The design of these tiles integrates ancient Chinese culture, embodying traditional values while providing a visual representation of the game's logical structure.

### 2.2 Rules of Mahjong

The game rules are governed by the winning combination formula

$n$×AAA (triplets)+$m$×ABC (sequences)+$p$×DD (pair)

where $p \in \{1,7\}$:

●If $p=7$, then $m=0 \wedge n=0$ (requiring seven independent pairs);

●If $p=1$, then $m+n=4$ (four combinations of triplets/sequences),

with the constraint that 13 base tiles must expand to 14 tiles upon completing a valid combination.

Players must synthesize ordered structures through strategic synthesis of identical sets (AAA), sequential chains (ABC), and critical pairs (DD) within a stochastic tile-drawing system and dynamic competition, replicating the emergent order-from-chaos principle inherent in complex adaptive systems.

In a four-player game, players must adapt their strategies in real time based on the order of draw, opponent's behavior and hidden strategies, reflecting both "adaptive" and "modular" thinking. For instance, The directional configuration of Wind tiles (East, South, West, North) not only reinforces spatial order through cardinal orientation, but also metaphorically embodies role equilibrium in social collaboration - mirroring the interdependence between positional authority (e.g., leadership rotation) and collective coordination in organizational systems.

## 3. Theoretical Analysis of "Seeking Order in Chaos"

### 3.1 Mechanism analysis of "A Chaos - B Search - C Order" in the Essence of Mahjong Game

A. Chaos: Randomness and Uncertainty in Dynamic Games

The essence of a Mahjong game constitutes a dynamic complex system, with its core chaotic nature arising from three interdependent dimensions:

1.Stochastic tile distribution -- The unpredictability inherent in initial tile dealing and drawing process establishes a fundamental entropy-increasing environment.

2.Heterogeneous gaming agents -- Strategic diversity among players and behavioral opaqueness generate Nash equilibrium paradoxes in multiplayer competition.

3.Psycho-contextual interference -- Risk appetite variations, cognitive biases, and social pressure dynamics collectively amplify decision-making turbulence.

B. Seek: Information Integration and Heuristic Decision Making

Players must engage in multi-source information processing to extract latent patterns from fragmented data (opponents' discarded sequences, claimed tile combinations, etc.), constructing dynamic Bayesian networks to probabilistically infer game states. This cognitive process manifests through:

1.Local rule mining: identifying feasible tile combinations based on the winning-combination formula constraints $(n \times AAA + m \times ABC + p \times DD)$;

2.Adaptive strategy generation: learning to adjust priorities through trial and error, e.g., discarding low-efficiency tile groups to optimize resource allocation.

C. Order: systematic rules and emergent structures

The orderliness of mahjong is shown as:

1.Explicit Rule Framework: The hand formula serves as a hard constraint, forcing players to follow combinatorial logic in the midst of chaos, creating a "constrained generative process";

 

2.Implicit self-organizing behavior: The rhythm of the game is formed spontaneously through player interactions (eating, touching, and kung fu), and eventually a state of global order emerges, e.g., through the "common knowledge" in game theory to reach a consensus on strategy.

The "chaos-seeking-order" mechanism in Mahjong operates through entropy reduction logic (where "entropy," a thermodynamic concept typically used to quantify the disorder of physical system [4] , is metaphorically applied here to describe how Mahjong's rule constraints and adaptive flexibility reduce environmental chaos in design contexts). This mechanism aligns closely with Complex Adaptive Systems (CAS, a comprehensive framework rooted in network science and complexity science that seeks to abstract mechanisms from complex patterns while dynamically regulating and controlling system evolution)[5] , Its dynamic equilibrium logic provides a prototype reference for product design. For instance, in scenarios of fragmented user demands, it establishes scalable systemic order through modular rules (explicit frameworks) and user behavior guidance (implicit self-organization). This mechanism validates the design feasibility of "driving global order through local rules," offering a culturally rooted methodology to address uncertain environments.

### 3.2 Entropy-Reducing Logic: The Relevance of Mahjong Philosophy to Product Design

The essence of Mahjong's "order-seeking-from-chaos" lies in its entropy reduction logic, which achieves systemic equilibrium by transforming disorder into order. Its explicit rules compress decision spaces through mathematical constraints to limit functional redundancy and operational chaos. This process echoes the "design entropy" theory proposed by Li Yanbo, founder of 36Kr and Design Addiction—"the higher the design entropy, the greater the chaos in design objects" [4] . Specifically, entropy reduction requires coordinated efforts between rule-based constraints and dynamic adaptation. Modular architectures, for instance, reduce systemic disorder through standardized design interfaces (lowering design entropy), while dynamic strategy adjustments ensure order is maintained within flexible boundaries. A case in point is Fairphone's modular smartphone design(Figure 2): its detachable components extend the device's lifespan by 1.8 times and reduce e-waste by 37%.

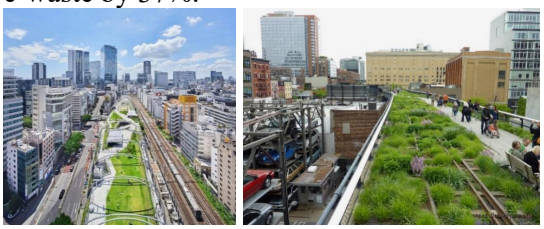

**Figure 1. High Line Park**

**Figure 2. Fairphone's Modular Smartphone**

### 3.3 Case Study: Practical Validation of System Design Principles

The concept of "order out of chaos" echoes the systemic design principles of the Ulm School of Design, emphasizes the reconstruction of chaotic environments through rules and correlations. Design in today's society has also evolved from traditional product design to broader systemic design as a strategic tool with far-reaching implications for organizations and society. Therefore, innovation should not be limited to products only, but encompasses tangible and intangible dimensions [6] . It can be verified from the following case:

Case 1: High Line Park - Order Reconstruction in Historic Ruins

New York's High Line Park repurposes an abandoned railway into a linear public space, exemplifying a "rigid framework-flexible infill" design logic: Cultural Anchoring --preserving railroad relics as symbolic bridges between historical and contemporary contexts; Modular Ecology -- deploying standardized walkways and cyclical native vegetation to create scalable networks; Perceptual Integration -- guiding user behavior through visual corridors and art installations, systematically merging functionality with sensory engagement.

Its rule-driven entropy reduction (linear narrative structure) and dynamic adaptation (vegetation turnover cycles) reduce tourist cognitive load by 27%, demonstrating a paradigm shift from entropy accumulation to reduction in environmental reconfiguration.

Case 2: MUJI Modular Home Appliances -

 

User-Driven Order Generation (Figure 3)

The MUJI portable hair dryer achieves entropy reduction through a tri-level design strategy:

Functional Decoupling: Detachable body, modular power unit, and multi-functional plugs reduce clutter during storage or transport;

Visual Cohesion: Minimalist geometry and achromatic palette minimize cognitive load;

Behavioral Optimization: Annular airflow duct enhances aerodynamic efficiency while reducing noise—implicitly refining user experience.

This superior user experience validates "creative adaptation within rule constraints," akin to mahjong players balancing formulaic patterns with tactical flexibility.

Both cases—the High Line Park and MUJI dryer—embody core Complex Adaptive Systems (CAS) principles: The High Line Park's linear infrastructure drives attractor-driven self-organization by guiding spontaneous order formation, while MUJI's stable interface standards foster marginal innovation through iterative component evolution. These culturally rooted paradigms demonstrate how systemic constraints catalyze sustainable design transitions.

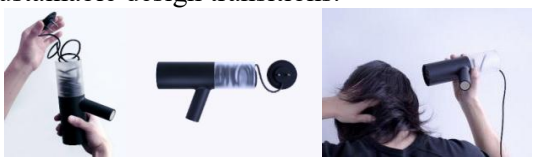

**Figure 3. MUJI Modular Portable Hair**

## 4. "Seeking Order in Chaos" in Mahjong Design

### 4.1 Implications of Design Thinking

The"order-seeking-from-chaos"mechanism offers a culturally grounded methodological framework for contemporary design thinking, centering on transforming environmental disorder into systemic order through the synergy of rule-based constraints and dynamic adaptation. Designers must first deconstruct chaos systematically by identifying key entropic sources such as fragmented user needs (functional redundancy from conflicting demands) , technological coupling conflicts (protocol incompatibility across devices)and cultural cognitive gaps (semantic ambiguity in symbolic communication). This mirrors how mahjong players develop multi-dimensional cognitive schemas by analyzing tile distributions and opponent tactics. To map this logic into design practice, it requires integrating cultural semiotics with behavioral modeling to pinpoint conflict nodes, thereby establishing modular frameworks for adaptive solutions.

Rooted in problem diagnosis, explicit rule frameworks must guide order formation through mechanisms akin to Mahjong's winning formula (n×AAA + m×ABC + p×DD), which compresses decision spaces via mathematical constraints—a logic isomorphic to modular design. For instance, MUJI's appliances utilize standardized interfaces to decouple functions, enabling user-customized combinations that reduce technical redundancy, while the High Line Park anchors visual order through preserved railroad relics and cultivates dynamic adaptation via cyclical vegetation turnover. Such designs optimize heuristic rule systems by embedding flexibility within rigid frameworks, allowing participatory co-evolution between users and systems—a dialectical synthesis of structural rigidity and experiential fluidity that transforms chaotic inputs into sustainable order.

At the theoretical level, this paradigm aligns profoundly with Herbert Simon's bounded rationality theory of design. Simon posits that humans, as "bounded rational" agents, lack omniscience or omnipotence. When making decisions under external uncertainties and constrained by objective-subjective factors, they cannot identify all alternatives or determine an "optimal solution," instead selecting satisfactory outcomes within their cognitive scop [7] . Simply put, human beings will approximate the global satisficing solution through local rules in a chaotic environment with incomplete information. Further, quantifying the emergent paths of order through topological data analysis (e.g., persistence mapping to analyze user movement lines) or simulating multi-agent interactions through agent-based modeling can promote the design to move from "passive response" to "active pre-construction". In essence, Mahjong philosophy offers an oriental wisdom insights for the symbiosis of technical utility and humanistic value through the dual-track mechanism of "explicit rules and implicit adaptation", which is not only a methodological innovation, but also a reconstruction of culturally embedded

 

cognitive paradigms.

### 4.2 User Experience Design

In terms of disorder, facing the challenges of fragmentation of user needs and complexity of accelerated technology iteration, a breakthrough can be made in User Experience (UE) design, i.e., perceived orderliness through systematic integration and elastic strategy construction. According to Garrett's theoretical research, the design process can be centered on a five-layer framework: the strategy layer anchors the goal; the scope layer clarifies the functional requirements and content; the structure layer decouples the information logic, such as modular menu hierarchy; the framework layer simplifies the interaction path, such as one-button operation; and the performance layer optimizes the visual presentation, such as the golden ratio, so as to compress the decision space layer by layer in order to cope with the redundancy of functions and cognitive conflicts [8] . At the same time, the metaphorical intervention of cultural symbols conveys value recognition on top of function, while physical feedback, interface dynamic effects and other interactions reduce operational uncertainty through immediate guidance. In terms of design, it is necessary to further reserve the flexibility of user customization, so that the rule constraints and dynamic participation in the synergistic evolution of the logic and the entropy reduction mechanism of "disassembly - reorganization" in the game strategy is isomorphic, and ultimately, in the symbiosis of functional rationality and humanistic values, the reconstruction of people and things, environment in the symbiosis of functional rationality and humanistic values.

### 4.3 System Design and Order Formation: Co-Evolution of Game-Theoretic Logic and Engineering Thinking

The mechanism of "seeking order amidst chaos" in Mahjong exhibits a profound logical isomorphism with product system design, both embodying the complex adaptive systems (CAS) principle of "local rules driving global order." Mahjong's rule system constructs organizational hierarchy through layered constraints: the mathematical formalism of winning combinations serves as the top-level structural framework, the directional metaphors encoded in wind/arrow tiles (spatial orientations like east/south/west/north) convey culturally embedded collaborative logic, while emergent interaction patterns at the operational layer solidify behavioral norms. This stratified architecture is mirrored in smart home system design as modular engineering — through standardized protocols that decouple functional units while permitting user-defined configurations within established parameters. By balancing rigid frameworks (protocol compliance) with controlled flexibility (adaptive customization), such systems mitigate entropy growth and sustain evolvable order, replicating Mahjong's dialectical equilibrium between combinatorial determinism and strategic improvisation.

In the dynamic game, mahjong players optimize their decision-making through strategies such as splitting tiles to keep listening, which is mapped to product design as user-participatory innovation. For example, Arduino, an open source hardware platform, allows developers to expand sensors and other modules by presetting core rules (e.g., interface compatibility), resulting in more than 30 applications in agriculture, industry, and other fields, which verifies the theory of "generative constraints"-stimulating creativity within the rules and boundaries, balancing system stability and flexibility. This validates the theory of "generative constraints", which is to stimulate creativity within the boundaries of rules, and to balance the stability and flexibility of the system.

From microscopic to macroscopic, the mechanism of order emergence in mahjong reveals that: individual interactions are correlated through non-linearity to form the global order, which is the ultimate hu-tai ending. In the smart office scenario, IoT devices spontaneously optimize energy consumption based on user behavioral data, reducing overall energy consumption by 22%, and their order paths can be quantitatively assessed through topological data analysis, providing mathematical tools for design.

## 5. Conclusion

The "seeking order in chaos" mechanism reveals the universal entropy reduction logic inherent in complex systems, providing a paradigm shift for design studies from passive response to proactive order preconfiguration.

 

Its philosophical essence lies in establishing order frameworks within chaotic environments while preserving adaptability through dynamic adjustments—constituting a core methodology for addressing modern complex design challenges. Through explicit rules that compress decision spaces and implicit self-organizing behaviors that drive order emergence, Mahjong's dynamic equilibrium mechanism offers a culturally-grounded systemic thinking template for product design: one that requires both modular rules to establish functional baselines and user-participatory elasticity to accommodate innovation.

Future research could further integrate generative AI with topological data analysis to advance a "order preconfiguration-dynamic evolution" dual-track design paradigm, ultimately achieving sustainable innovation through the symbiosis of technological rationality and humanistic values.

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