

Figure 12. Impact of immediate reasoning on the designs of artifacts

Hierarchical social rules have influenced the designs of many traditional Chinese artifacts with unsurpassable power. They strictly regulate size, style, color, decoration, material choices of architecture, clothing, chair making, etc. Breaking the rules could put one in prison or even killed in the old times.

Symbolism is probably the most important characteristic of Chinese art and design that adds emotional, spiritual and contextual qualities to artifacts. Numbers, directions, materials, colors, shapes and auspicious patterns can all carry symbolic meanings with references to Yin-Yang and Feng-Shui ideas.

Aesthetics preferences and ergonomic considerations become primary design decision factors when hierarchical rules and symbolic meanings pose no restriction or limitations. It can often be noticed in the designs of Ming style furniture (Fig. 20).

The advancement of technologies is often an important driver of novel artifacts. As it reaches its maturity, it becomes less decisive. For instance, without the development of the gear drive mechanism, the water-powered waterwheel would not have been developed as a farming tool. However, the maturity of water power technology did not completely replace man or animal powered wheels. The choices were often made accordingly based on the context of use.

3.1.3 Influential Factors

Influential factors include SETIG factors of specific historical periods, traditions and philosophical foundations (Fig. 13).

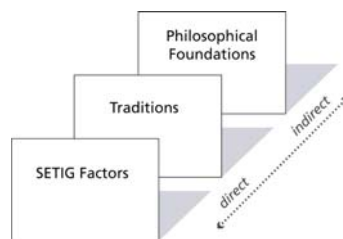


Figure 13. Impact of influential factors on the development of artifacts

SETIG factors of a particular historical period directly influence the development of artifacts. Usually, social conditions determine the appropriateness of an artifact and who the user will be; economic situations affect how quick an artifact spreads to what level of the society; new technologies make new artifacts possible; ideologies indicates deeper philosophic and cultural value an artifact; and geographical background gives an artifact regional characteristics.

Traditions are customs, practices and ideas developed over long periods of time. They heavily influence people's daily life. Holidays and special occasions such as wedding ceremonies have generated hundreds of artifacts for special usages. Sometimes traditional rules tell us what is or is not an appropriate gift for someone at certain occasions.

Taoism, Confucianism and Buddhism are widely known philosophical foundations of Chinese culture. Confucianism focuses on social ritual and human relationships, and emphasizes the social role of art and art appreciation. Taoism focuses on cosmos view and epistemology. Taoist aesthetics seeks harmonious relationship between human and nature. Buddhism strongly influences the daily life of Chinese people. However, it does not have very direct influence on Chinese art and design, except for providing religious subjects for the arts.

Traditional Chinese medical theory and aesthetics may also provide philosophical inspirations.

3.2 Impact Analysis of Cultural Artifacts

Understanding how different design decision factors affect the design of an artifact and how they relate to each other allows us to create an Impact Analysis of these factors (Fig. 14). It provides a structure of design decision factors with indications of relative degrees of priority.

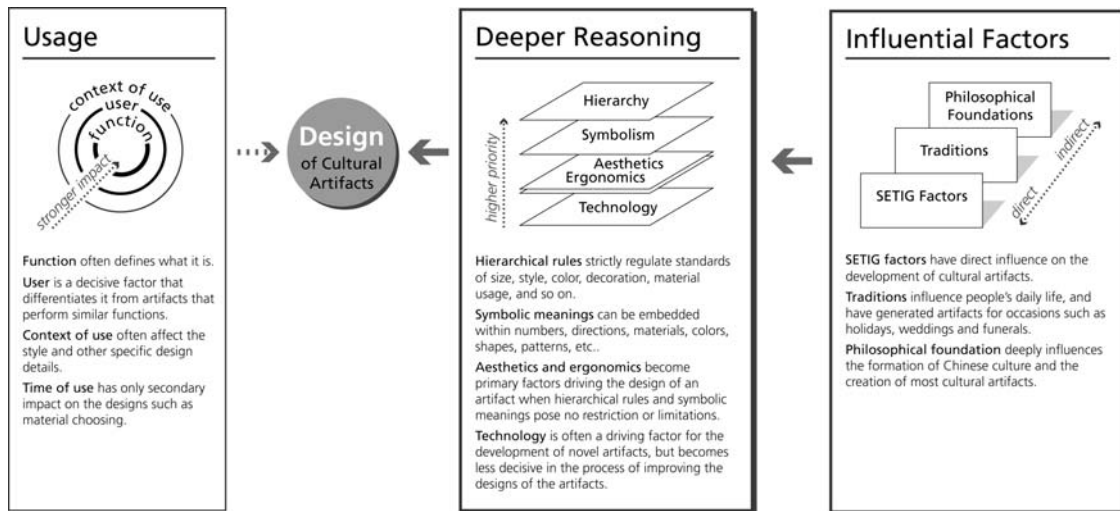


Figure 14. Different factors that have impact on the design of cultural artifacts

When this Impact Analysis is applied to specific artifacts, it can generate a general decision impact structure that serves as a procedural design guideline to check hierarchical rules, symbolic meanings, aesthetic preferences, and so on. Figure 15 is a study of Hui Style private houses. Here, we notice that the influential power of a decision factor may vary when it is applied on different aspects of the design. For instance, even though hierarchical rules generally have the strongest reasoning power, aesthetics might share the same level of influence when choosing the styles and materials of a private house.

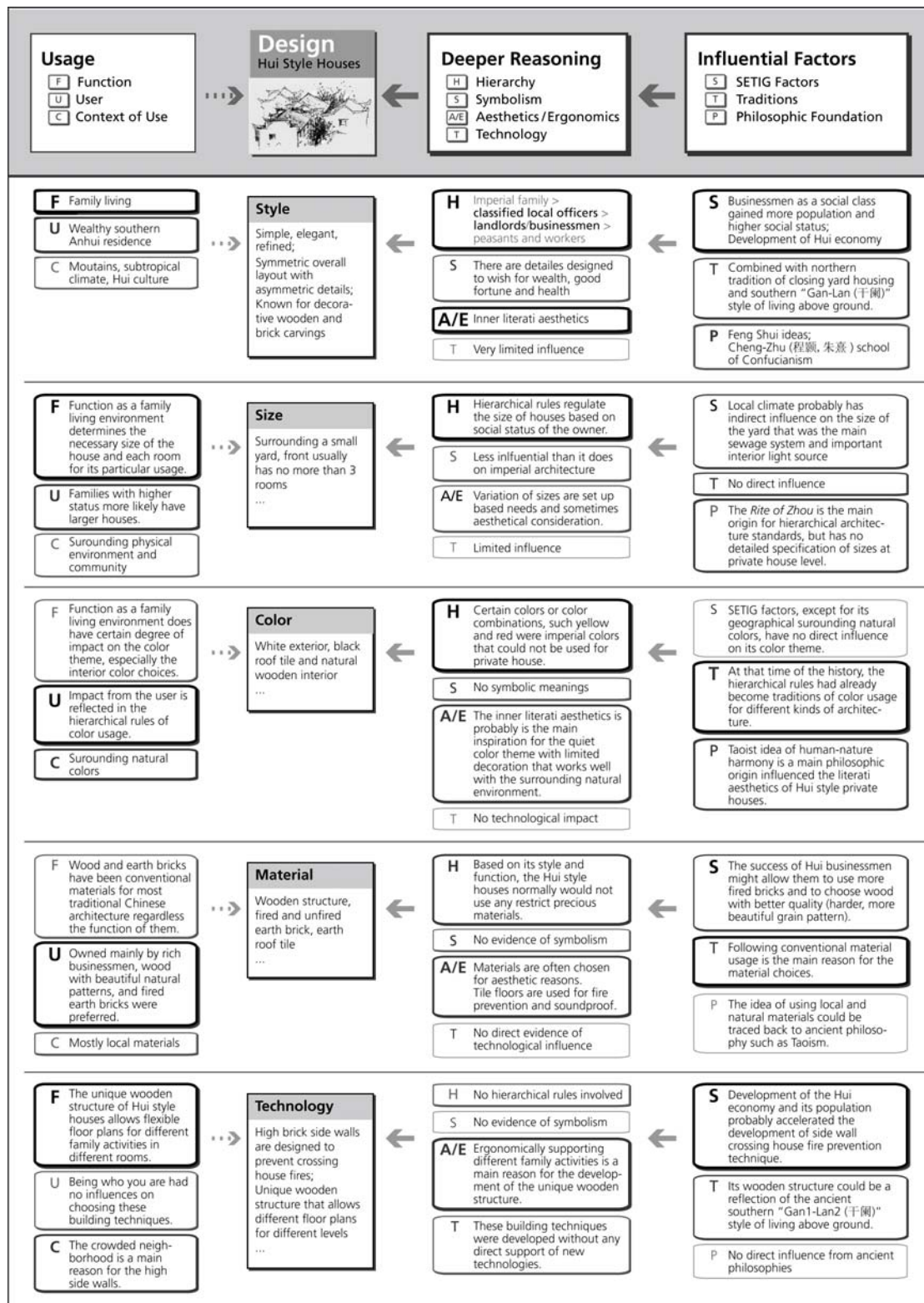


Figure 15. Impact Analysis of Hui Style private house design

Different decision structures may emerge based on the different types of artifacts studied or the classification of artifacts. Usually, when a general class of artifacts, such as traditional architecture is studied, it generates a general structure of decision factors with indications of relative influential power. When the Hui style private houses, it begins to generate a more specific guidelines of design with clearer indications of preferred and avoided design choices (Fig. 16). Clearer and more detailed grammatical rules emerge as the classification goes deeper.

	Classification of Artifacts	Examples
<p>General Structure of decision Factors</p> <p>↑</p> <p>•</p> <p>•</p> <p>•</p> <p>•</p> <p>•</p> <p>↓</p> <p>Specific Guidelines of Design</p>	A General Class of Artifacts	Traditional Architecture
	A more specific class of Artifacts	Traditional Houses
	A particular class of Artifacts	Hui Style Private Houses
	Specific Artifacts	Front Gate of Hui Style Houses
	Details of Artifacts	Front gate decoration of Hui Style Houses

Figure 16. Different levels of Impact Analysis

4 SHAPE GRAMMAR OF CULTURAL ARTIFACTS

Primarily explored by architects and engineers, shape grammars are used for numerical form analysis and computational formal engineering design synthesis. Early studies include George Stiny’s “Two exercises in formal composition” (1976), and “Introduction to shape and shape grammars” (1980). The ideas have been used to generate a variety of designs including Chinese lattice designs by Stiny published in 1977 and Frank Lloyd Wright’s prairie houses by Koning and Eizenberg in 1981.

Although most Chinese artifacts contain complex and subtle cultural messages, shape grammars can be used to study the exterior formal languages of them. For instance, since the old social hierarchy no longer exists and the context of use has been changed, developing shape grammars for a Yokeback Armchair is possible when necessary. By studying the parts and their variations of a Ming style Yokeback Armchair (四出头官帽椅) (Fig. 17), we can start to build a preliminary compositional shape rule schemata of it (Fig. 18). Even though a complete shape grammar requires much more complex rule writing for the formation of each chair part, this exercise shows it can be done. Some culturally appropriate parts or structural options can be prioritized through rule writing. To choose a preferred design among many available options generalized by grammars, users’ preferences, contexts of use and designers’ aesthetic intuition may be relied on.

	Seat Frame	Core structural part that holds everything together, allows thinner seating board, and maintains line based visual unity.
	Seating Board	Hard wood panel or woven seat
	Front Leg Back Leg	Legs of Ming dynasty chairs stand with a small angle towards inside of the seating board, while the legs of most Qing dynasty chairs stand straight.
	Crest Rail	The protruding ends of the crest rail differentiate this chair from Southern Officer's Hat Style chairs, which also look like officer's hat but have no protruding ends on both the crest rail and arms.
	Splat	S-shaped splat is a common feature designed for comfortableness of all Officer's Hat style chairs. It sometimes has carved or inlaid decoration with positive symbolic meanings, such as longevity.
	Arm	The arms separate this chair from another very popular chair style, side chair (靠背椅 或 灯挂椅) with similar design without arm rest.
	Goose-neck Support	Goose-neck support is a common arm support style of Officer's Hat style chairs, including both Yokeback Armchair and Southern Officer's Hat Chair.
	Reinforcing Spandrel	Arm reinforcing structure; Some do not have the spandrel
	Side Post	Important additional arm support (variations shown below)
	Footrest	Unique design for almost all Ming and Qing dynasty chairs
	Base Stretcher	Important for both structural stability and visual composition
	Square Share Apron	Unique reinforcing structure of Chinese chairs, tables and other types of furniture

Figure 17. Ming dynasty Yokeback Armchair 四出头官帽椅

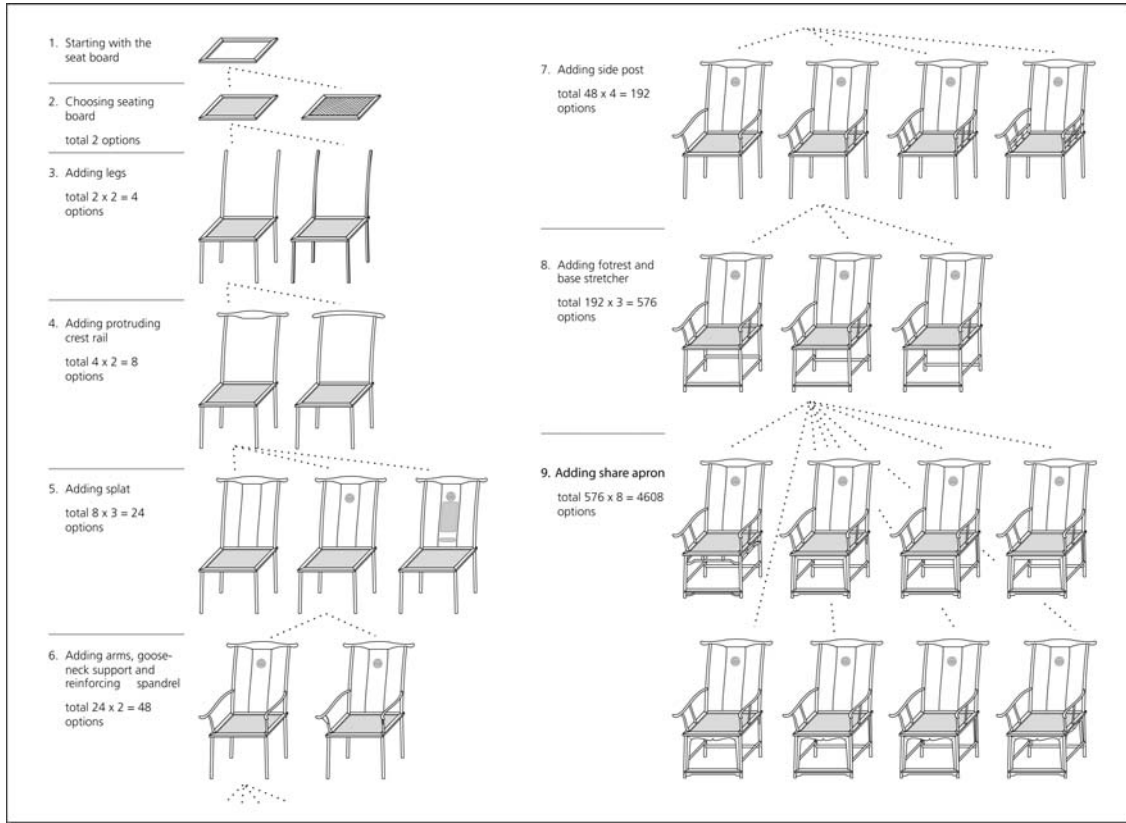


Figure 18. Basic composition shape rule schemata for Ming dynasty Yokeback Armchair

5 VISUAL LANGUAGE ANALYSIS

Visual language analysis, also known as product semantics, allows us to transform subtle visual appearance into new design concepts. It can be used to study the overall visual appearance of an artifact, and can be focused on size, proportion, color, decoration, visual pattern or texture. Figure 19 left is visual language studies of the Temple of Heaven roof line. The roof slope of Q_{i_2} - N_{ian_2} - D_{ian_4} , which is determined by the roof height and its diameter (or depth), illustrates a subtle visual difference between architecture from different periods. Figure 18 right shows different artifacts share similar visual language. However, certain cultural knowledge is required to understand the different design factors behind the external visual appearances. For instance, while the roof line of Q_{i_2} - N_{ian_2} - D_{ian_4} is heavily affected by the symbolic meanings of its overall height and the lower level roof circumference, the roof line of a private garden pavilion is influenced more by aesthetic preferences and the preferred sunlight exposure time. A garbage bin in Beijing imitates the roof line of traditional architecture, and a tea cup simply shares the similar visual language.

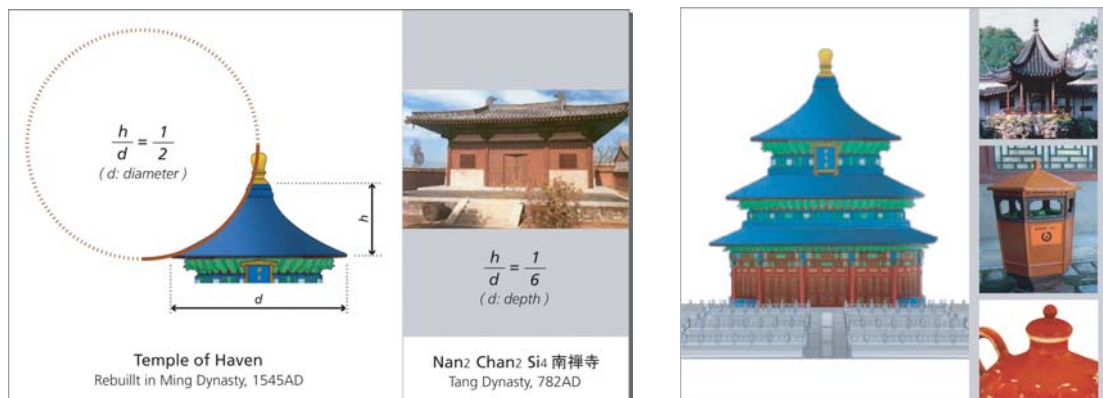


Figure 19. Visual language study of Q_{i_2} - N_{ian_2} - D_{ian_4} (祫年殿) roof line

