

How to Think Like an Artisan

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ABSTRACT

Studies about designers have been carried out on subjects with a formal educational background to investigate ideas and design activities. On the other hand, the design thinking of an unselfconscious artisan has not received much attention, even though its design has a unique approach. This research examined an artisan's design cognition who thrives under a non-drawing culture—a protocol analysis exposes the cognition content and process. Noticeable deposition on several cognition state spaces indicated the remarkable competencies of the artisan. This paper discusses the deposition contents and their traits.

Keywords: *Design Cognition, Bali Aga, Traditional Craftsmanship, FBS.*

1. INTRODUCTION

Designing begins to be studied scientifically by testing the model, with the underlying assumption that designing is a process and has cognitive content. In the Introduction to Design, Moris Asimov [1] initiated an examination of a designing model to be recognized methodologically. The design model analyzed the designer's activities in solving problems, so naturally, the study focused on the process. Nearly three decades later, John Gero [2] proposed a new design model that focuses not only on the process but also on the content that uses variables and decisions about these variables' values to achieve goals.

Most of the subsequent studies explore processes and contents that reveal cognitive performance in sketching. Sketching, known as an intensive thinking activity, becomes a potential source in collecting cognitive design data and tells what happens in this activity [3–16]. Sketching is considered an outpouring session of design thinking, a designer's reflective conversation [3], or a backtalk [6]. Stimulating imagination, reasoning from something unfinished and still developing [11], or a tool for finding unexpected meanings, many interpretations, ambiguous concepts, and new ideas [5,6,13,16,17] are

the definition amongst sketching process researches. Suwa et al. [18,19] state that a designer solves design problems using intermediary sketches to crystallize ideas in the early design stages. The statement indicates actions of finding, repairing, and revising relationships between components.

When an artisan does activities without any drawing medium as part of an initial stage of designing, the artisan phenomenon emerges. Artisan processes directly with the design object and carries it out as a natural and automatic method. The question arises, how does an artisan express his design thinking without using intermediary media? The missing crystallization process of the artisan design thinking is questioned. This research aimed to examine the design cognition that occurs in the mind of an artisan. This research includes three aspects of the discussion: (i) what does the artisan's unselfconscious design thinking mean? (ii) how is it examined? (iii) what can we learn about artisan design thinking? A robust traditional bond forms a crystallization of ideas on long-term memory. The knowledge gained from this experiment shows how to support the design process that brings designers closer to the designed object. The following theoretical framework addresses the first two questions. The experiment result answers the last

question. This experiment exposed the crystallization state spaces of an artisan's design cognition and its traits.

2. THEORETICAL FRAMEWORK

2.1. *The unselfconscious design thinking*

Christopher Alexander [20] classifies differences in design thinking into self-conscious and unselfconscious. He describes that the self-conscious culture is formally shaped by education, which always advances, demanding new answers to the challenges that develop simultaneously. In contrast, the unselfconscious culture does not have the freedom to innovate because of traditional firm boundaries, which only define themselves by making problem-solving repetitions. Besides, Balaram [21] sees the process of designing in artisan naturally as an unselfconscious culture. He explains that the thinking approach is based on refined and modified actions through collective awareness and intuition. Design thinking and problem-solving are implied without drawings or pre-plans because intuition mostly plays a role. Consequently, Goldschmidt [22] sees an effort to adjust to every failure that occurs as a practice-reversal to achieve the right shape and maintain dynamic balance.

These statements emphasize that artisans by trade are formed through informal training as part of their belief system. They are educated on professional skills, referring to Ingold [23] as a live performer to create an artifact. Artisan without drawing culture is determined by hands-on learning, which embodies action and perception.

2.2. *Protocol analysis*

Protocol analysis was used to obtain information about cognitive processes in the internal investigation of subjects with verbal methods [24]. The plot of conversation analysis done by Oak [25] was one way to obtain verbal data. The activity reviewed the designer's understanding of the working environment (in situ) surrounded by design objects and artifacts, which were discussed. He claimed this method encourages participants' understanding in designing meaningfully both personally and socially. Preparation, experiment, transcription, parsing, encoding, and interpretation [26] are the stages to do the research.

Furthermore, Kan and Gero [27] stated that the preparation and experiment are determined by the purpose of the research and methods. Equally important, parsing and encoding are tailored to the study's goals and scope. In parsing and encoding the protocol data, one of the steps is to define the analysis unit. There are various ways and views in determining the unit. Kan and Gero suggested action or utterance expressing the aspect of designing. Goldschmidt [22] introduced design moves, which is an act that transforms the design situation. Suwa et al. [28] suggested identification using human cognitive process sequences (sensory, perceptual, and semantic).

To further examine design protocols, researchers utilize a coding scheme. The Function-Behaviour-Structure (FBS) ontology [27] is claimed as a universal categorization across the design domain, as a foundation to understand the design process and content. Meanwhile, Suwa and Tversky [19,29] focused on the designing process because the scheme's purpose addressed a specific research aim. However, they came up with a different method for analyzing conceptual dependency among segments. Dependency chunks (DC) consists of the focus of attention (focus shift) and their act of exploring related topics (continuing segments). This perspective claimed to be able to "see" what the designer sees in practice. In this research, we proposed a DC unit from a different stance, as explained in section 3.2.

In summary, this research devised two analysis approaches to examine the crystallization process of designing. First, crystallization denotes the deposition of contents, which is best examined with the FBS ontology. Table 1 was prepared to segregate content location, types of content, and traits for a more straightforward encoding process. Second is the process per se that was reviewed with both FBS and the dependency chunks concept. Both analyses came from the same verbal dataset.

3. EXPERIMENT: DESIGN REVIEW CONVERSATION

The puritan Bali Aga society, who lives in the Pengotan village, sees the designing practice as compliance with traditional values and norms. While the freedom to design can emerge when facing new challenges outside the tradition, faced with the provision of past conventional skills [30].

Table 1. FBS ontology traits.

Code	Outside	On the Artifact	Inside	Purpose	Attributes	Components	Traits
Requirement [R]	•			•			Set of purposes/goals; context requirements; physical context limitations.
Function [F]			•	•			Set of purposes/goals; the predictive concept in response to purposes.
Expected Behaviour [Be]			•		•		Common knowledge; convention; agreed attributes; affordable/accepted attributes; prediction of the involved attributes.
Structure Behaviour [Bs]		•	•		•		Required attributes; limitation statement, agreed method; known predicted components and how it works (sometimes expressed but intangible).
Structure [S]		•	•			•	Known working elements or components (sometimes expressed but intangible).
Design Descriptions [D]	•	•				•	Artifacts, design object, proofed/accepted concept.

This study applied a purposive sample of artisans who live in a naturally unselfconscious culture. I Wayan Parma, also known as Nang Caba, is one of the leaders of indigenous peoples who has the authority to design and construct buildings in the social structure of Pengotan village. The subject has the capacity as a participant who has a long experience as an undagi (master builder), despite thriving and working without a drawing culture. There are two steps to take in examining his design thinking systematically.

3.1 Conversation Topics

Bale Meten, as a part of a Balinese house, has uniformity and variety at the same time. There is a system that governs this vernacular artifact. A preliminary interview was conducted to gather the design and construction process of the archetype. Then, the information was formalized into a series of animations as design topics to discuss. All 24 images shown in Figure 1 were printed in A4 size paper and presented to guide the conversation. Later, the design review took place at *the ampik of Bale Meten* (porch of the house), strengthening the ambient awareness (*in situ*).

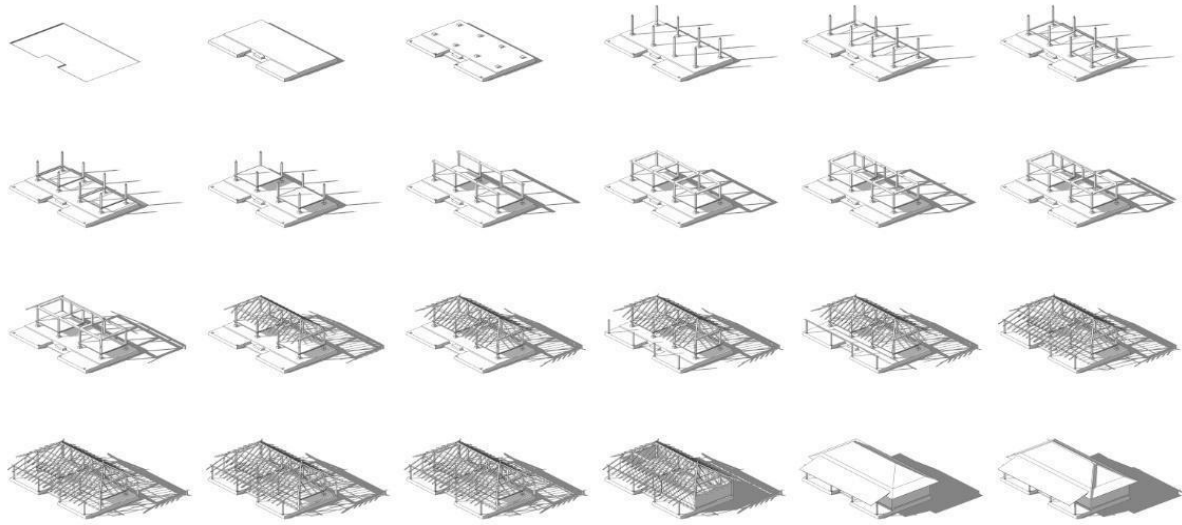


Figure 1. Animation of the Bale Meten construction process.

Table 2. Segment categorization

Segments	Descriptions	Code
Propose	Suggesting a design	R
Examination	An in-depth question	R
Reference	A statement that indicates a relationship out of the topic	F
Objective	A statement of goal	F
Confusion	An expression of bewildered	Be
Affirmation	A simple reply of agreement	Be
Disagreement	Expression of disapproval	Be
Questioning	The expression of doubting	Be
Calculation	A thinking process of transforming inputs	Be
Explanation	Describing something that is not processed, nor properties, or even an element	Be
Evaluation	Usually-repeated statements to make sure the previous ones	Be
Thinking	An expression of considering something	Be
Confirmation	A long reply statement	Bs
Rules	A statement of governing principles (general)	Bs
Lexical	A statement that relates to rules of designing (traditionally related)	Bs
Realizing	An a-ha moment	Bs
Excitement	Enthusiasm or eagerness expression	Bs
Surprise	An unexpected reply expression	Bs

Assurance	The person is assured of a value that is discussed	Bs
Alternate	A statement that indicates other possibilities	S
Properties	Describing a parameter of an element	S
Tool	Describing a way or utensil of processing	S
Processing	Describing a process	S
Material	A definition of matter	D
Element	A state where a part of a design object is made, not explained	D

3.2 Transcription, parsing, and encoding

Design review conversation ran in two sessions, 1:03 hour on the first day and 1:28 hour on the second day. It was transcribed into 2532 rows of data and expanded into 34 topics of discussion. In this research, we devised two parsing methods. Firstly, a semantical meaning classified the protocol data into 25 segments by asking what the phrase implies in the design review context. They were then categorized into FBS ontology, as shown in Table 2. Secondly, it is a

grouping of an answered central question. It is a nature of conversation as a reciprocal dialogue that contains a series of questions and answers. The unit of an idea in conversation is a series of answers to the discussion context's central question. There are 85 units found in the dataset. However, only the artisan's utterances that counts in the analysis. Table 3 shows an example of a unit, and later on, it is called a dependency chunk (DC) when the artisan asked about the roof construction.

Table 3. Examples of dependency chunk

Utterances	Segment	Code	
"Kalau itu sudah jurainya . "	Element	D	Focus shift
("That is the ridges.")			
"Kalau itu sudah sering saya pakai e.. acuan kalau kita mau keluarin pondasinya 60cm dari tiang itu"	Explanation	Be	
("I used them all the times, hm.. it is the reference point if we would like to offset the footing lines 60cm off the post")			
"Berarti sudah yang jurainya ini sudah pasti "	Assurance	Bs	
("That signified the ridges, definitely")			
"Sudah pasti 1m ."	Properties	S	
("Definitely 1m.")			
"Nanti kita tarik pakai benang.."	Tool	S	Continuing segments
("Then, we will pull a string..")			
"Sudah nyampe sana."	Calculation	Be	
("Pull to that end.")			
"Pasti!"	Assurance	Bs	
("Definitely!")			
"Pas hasilnya begitu"	Assurance	Bs	
("Precisely measured")			
" Tinggal ke kaso nya terpotong , lisnya sudah di sana nanti arahnya"	Explanation	Be	
("Next, the rafter will be trimmed, and the eaves will be in that direction")			

4. RESULTS

What can we learn about artisan design thinking? The two parsing methods showed the cognitive load concentration and its characteristics in the design state space.

4.1 Design review conversation intensity

The data protocol consists of 2532 lines, divided into 1387 (54.8%) utterances from the subject and 1145 (45.2%) lines of the interviewer—almost 94% of the artisan's utterances are dependency chunks. Table 4 shows the distribution of the protocol data. The statistical data indicates that the design review conversation has put the artisan at the core of the data gathering process. Whether it is in the conceptual understanding of the Bale Meten design, or the application of the making, the response made by the artisan has a profound impact on long-term memory performance.

Table 4. Segment distribution of the protocol data

Segment types	Artisan
Focus shift	[two dependency chunks in length] 4 (5%)
	[more than two dependency chunks] 81 (95%)
Continuing	1225
Total of Dependency Chunks	1300

Figure 2 shows the condition where *reference*, *affirmation*, *disagreement*, *evaluation*, *confirmation*, *alternate*, *processing*, and *element* are the impetus segments of focus shift in the design review conversation, above the average. The motivation is mainly triggered by the expression of disapproval, a long explanation reply, and the state of the design object part created. The artisan saw the artifact from a built Bale Meten as something that is finished. The design intention in the artisan's mind is to produce artifacts that behave as what is outlined not only by purpose but also by custom. The reference and disagreement segments prompt the conversation to return to the ideal artifact structure whenever there is a different concept outside of his understanding. Thus, the completion of design is an accepted concept that is stored in mind. Therefore, he can eloquently explain the flashback process.

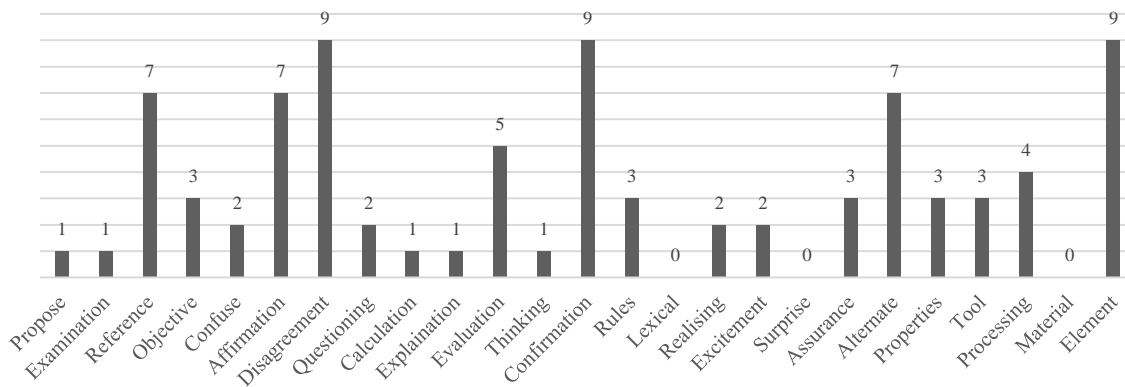


Figure 2. The focus shift segment distribution

Next, the *explanation* class dominates the intensity of continuing segments. It means that act of describing is the central stimulus in continuing design review. The second group that motivates in continuing segments is the *affirmation*, *calculation*, *confirmation*,

rules, *properties*, and *processing*. This analysis means explaining the concepts, describing properties, and processing was the artisan's remarkable design thinking competencies to confirm the final design results. Figure 3 exhibits the analysis in this statement.

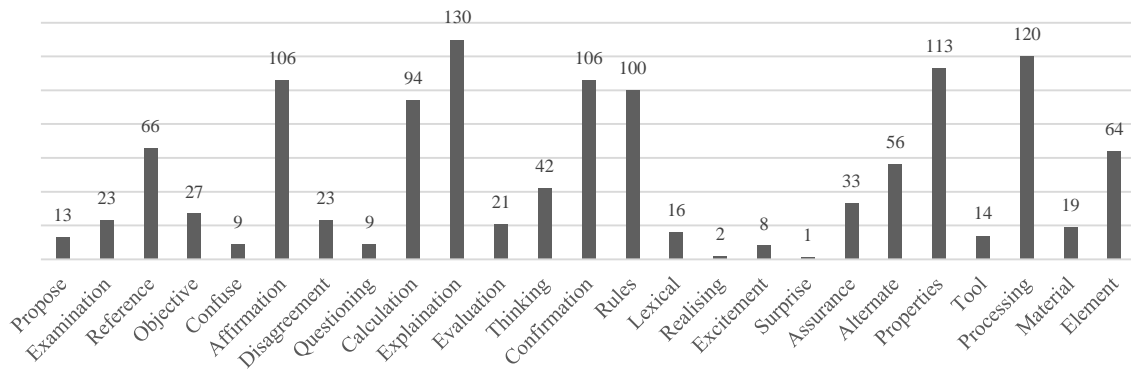


Figure 3. The distribution of the continuing segment

4.2 Analysis of the design thinking characteristic

The overview analysis of the protocol data distribution in Table 5 presents that the *expected behavior (Be)* is the main driver for changing this design review's focus. It means that, as described in Table 1, *Be* characteristics became the state of the design benchmark in artisan decision. The *expected behavior (Be)*, *structure behavior (Bs)*, and *structure (S)* categories have a high-intensity segment representative. It means that the process of cognition actively works in each state space. Moreover, the flow indicates information retrieval from memory and then compares the actual conditions with memory. Also, the process of self-acceptance of the completion ran entirely on an artisan's design thinking. These traits are the artisan's reliability, stored well in long-term memory, and ready to be recalled swiftly.

Identifying unsuitable conditions outside the artisan's conception forced him to evaluate the incoming information. Meanwhile, recognition of

prior knowledge was a readily available tool. Nevertheless, this knowledge was not built in the same views of the self-conscious culture. Results show that *synthesis (Be → S)*, *analysis (S → Bs)*, *evaluation (Be ↔ Bs)*, *reformulation type 1 (S → S)*, and *reformulation type 2 (S → Be)* of the FBS ontology model [27] are notably involved (see Table 5). Thus, the highest intensity emerges in the *synthesis* and *reformulation type 2* process, where the *expected behavior (Be)* became the central part, as illustrated in Figure 4. *Synthesis* means that the artisan is likely elaborating the information into known variables and producing symbolic representation. While in *reformulation type 2*, the cognition loads focus on enriching the attributes of the artifact structure. It means artisan shapes the expectation to fit the reality derived from the construction of attributes. The detailed process refers to Tomasowa's publication [31].

Table 5. Segment distribution of the protocol data

Design State Space [Code]	Focus Shift	Continuing Segments
Requirements [R]	2	36
Functions [F]	10	93
Expected Behaviour [Be]	28	434
Structure Behaviour [Bs]	19	266
Structure [S]	17	303
Design Description [D]	9	83

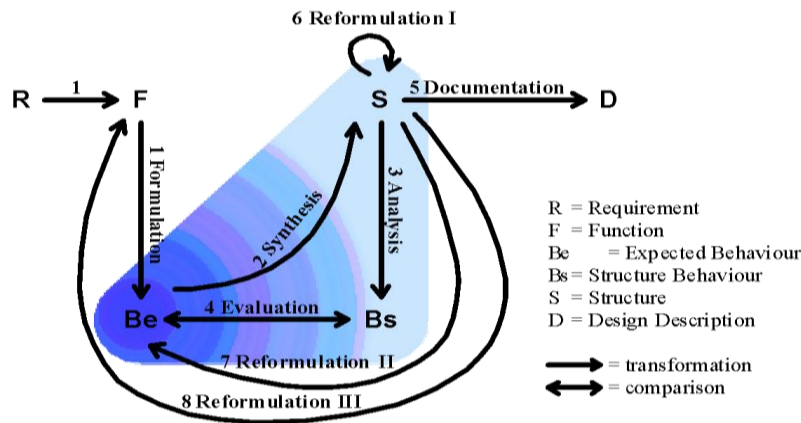


Figure 4. FBS content and process distribution

5. DISCUSSION

The following perspective illustrates the discourse of the design thinking culture. An educated designer will likely try to surpass unexpected design challenges with all his or her abilities. One will change the uncontrolled design state into something ideal (good fit) to express a new design and exceed the initial mental image. On the contrary, an artisan by trade will confront unforeseen design challenges with all the skills one has to get the design "back" into the expected shape, at least close to the initial mental image. However, these two subjects make a design breakthrough that has a different perspective and context. The designer does the novelty of the design by exploration out of the crystallization of ideas.

Concurrently, the artisan maintains design expression with an adaptable approach through the consequence of a slight modification. This hylomorphic philosophy, lived by a Bali Aga's artisan, has implications for the continuity of design and making, which cemented the artifacts and cultural traditions for years. We witnessed a collection of stored functions that are preserved from experiences of repetitive works. Indeed, this is the entire system that distinct the purpose of crystallization of ideas that Suwa and Tversky meant in sketching. The intimate relationship between the artisan and the artifact, more than a teleological, indicates the artifact somewhat deposits.

6. CONCLUSION

This research aimed to examine the design cognition of an unselfconscious Bali Aga artisan. The three addressed questions were presented in the paper, and we proposed an analysis method for design review conversation. An overview of the cognitive design

discourse was discussed; however, we cannot conclude this summary as general knowledge of the artisan design thinking. The critical impetus for focus shift that leads to the in-depth cognitive material was elaborated, and the analysis of the dependency chunks and stimulus segments were discussed.

In addition to further research, behavioral observation would likely complete what design review conversation has lacked concerning the designing action. It also would address the analysis scheme and its potentials in developing the feature engineering of design cognition.

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