

Systematization of Patterns: How to Craft a Pattern Language as a Whole

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This paper presents a method of “systematization” for crafting a system of a pattern language. Christopher Alexander, who invented the concept of pattern language, emphasized that patterns do not exist alone but are related to each other and form a coherent system. However, there has been little discussion on how to conduct systematization of patterns. Based on this background, we have developed our own method of systematization after more than ten years of practice in crafting pattern languages. The method comprises three phases as follows: In the first phase, identify three main parts that constitute the whole of good practice and classify ‘pattern ingredients’ into these main parts; in the second phase, identify three sub-parts for each main part and classify pattern ingredients into the sub-parts; and in the third phase, craft three ‘pattern seeds’ from pattern ingredients for each sub-part, determine their order, and write a summary of their essence. This approach results in a structured system where the entire system is divided into three main parts (categories), each of which is further segmented into three sub-parts (groups). Each sub-part (group) is associated with three distinct pattern seeds, collectively forming the coherent system of the pattern language. Note that systematization, a part of the crafting process of a pattern language, is best conducted with a team rather than alone to eliminate subjective biases. In the team, at each stage, each member introspectively reflects, articulates their thoughts to others, and engages in discussions to validate these thoughts. This paper also presents examples of systems of pattern languages we crafted so far.

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1. INTRODUCTION

Patterns in a pattern language are interrelated and form a system, rather than existing in isolation. In Alexander’s book *The Timeless Way of Building*, he stated, “the possibility of language is latent in the fact that patterns are not isolated” (Alexander 1979, p.309). To produce good quality in a specific field, it is crucial to integrate and apply multiple interrelated patterns, rather than relying on a single pattern.

Similar to other languages, such as natural languages, the meaning of each element, be it a word or a pattern, is defined by its placement in the system. Therefore, forming a system is essential, alongside writing individual patterns. In other words, it is a process of clarifying the relationships among individual patterns, grasping what the pattern language as a whole is composed of, and putting it together as a system. We call this *systematization*. The system, as Alexander proposed, encompasses the arrangement and interrelations of patterns, integrating the meaning of the whole into its parts. Note that systematization is carried out in the process of crafting pattern language, which we developed and improved, as shown in Figure 1.

In the following sections, we will first overview Alexander’s perspective on the system of a pattern language, and then present examples from our pattern languages.

2. SYSTEMATIZATION OF A PATTERN LANGUAGE

Alexander defines a pattern as follows: “Each pattern is a rule which describes what you have to do to generate the entity which it defines.” (Alexander 1979, p.182) and also “Each pattern is a three-part rule, which express a relation between a certain context, a problem, and a solution.” (Alexander 1979, p.247). It is well known that *Context*, *Problem*, and *Solution* are the main sections when forming patterns.

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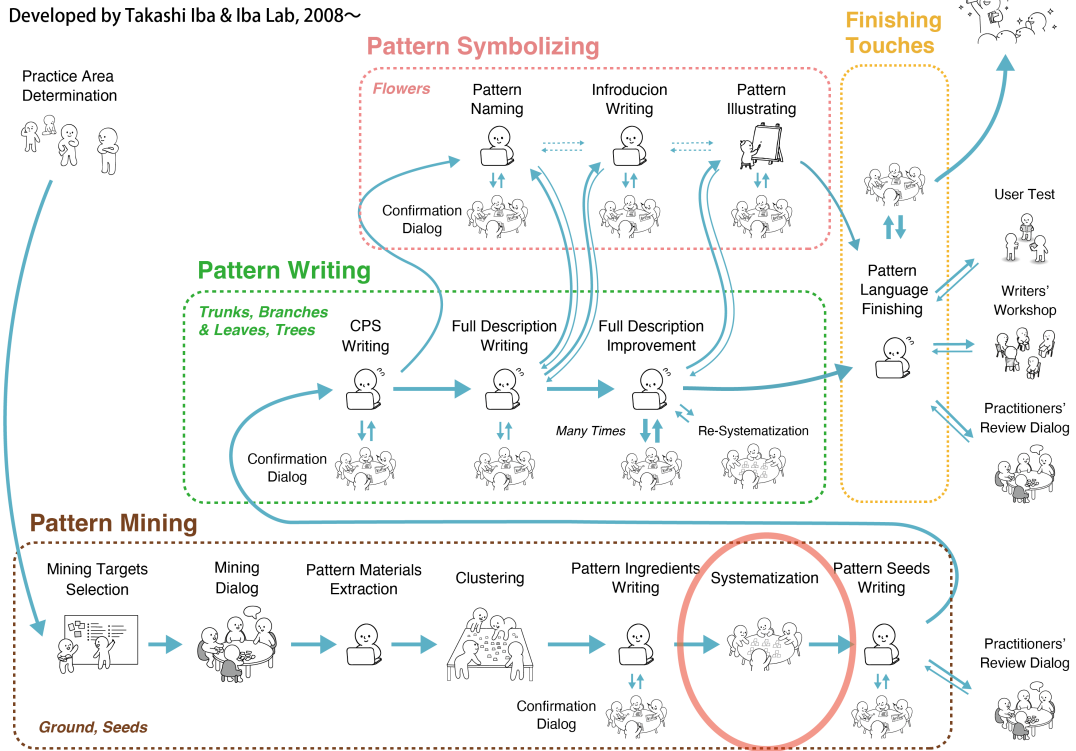


Fig. 1: Systematization phase in the process of crafting a pattern language.

Patterns in a pattern language are interrelated; Alexander said, “the system of patterns forms a language” and he goes on to say the following:

“It is, indeed, the structure of the network which makes sense of individual patterns, because it anchors them, and helps make them complete. Each pattern is modified by its position in the language as a whole: according to the links which form the language.” (Alexander 1979, p.315)

And he says, “it is the network of these connections between patterns which creates the language” (Alexander 1979, p.313). The patterns that weaved together become worthy of being called a pattern language. This is the difference between a pattern collection and a pattern language. And, as he expresses, “In this network, the links between the patterns are almost as much a part of the language as the patterns themselves.” (Alexander 1979, p.314).

In the pattern languages crafted, patterns are intricately connected, forming a network of relationships. For example, the patterns in a pattern language for living well with dementia, *Words for a Journey*, are interconnected, as illustrated in Figure 2. It reveals the underlying network of related patterns, demonstrating how they are semantically interwoven.

Note that we, the creators of the pattern language, have deliberately chosen not to present this network diagram to its readers, who are often elderly individuals with dementia, their families, or their surrounding supporters. This decision stems from the intention to prevent these readers from feeling overwhelmed by the complexity of the entire structure. For them, it is adequate to understand about three related patterns connected to the one they are reading, without the need to grasp the complex entirety of the network. Consequently, we reserve the presentation of this network diagram for academic papers and presentations.



Fig. 2: A network of related patterns in *Words for a Journey*.

Furthermore, he says that pattern language woven in such a way will result in a lively and good quality pattern:

“And in virtue of its position in the whole, each pattern becomes especially intense, vivid, easy to visualize, and more richly visualized. The language not only connects the patterns to each other, but helps them to come to life, by giving each one a realistic context, and encouraging imagination to give life to the combinations which the connected patterns generate.” (Alexander 1979, p.315)

Based on the above, Alexander asks, “how do I know if the language is a good one?” (Alexander 1979, p.315). Alexander’s answer to this question is as follows:

“The language is a good one, capable of making something whole, when it is morphologically and functionally complete. It is morphologically complete, when the patterns together form a complete structure, filled out in all its details, with no gaps. And it is functionally complete when the system of patterns has that peculiar self-consistency in which the patterns, as a system, generate only those forces which they themselves resolve --- so that the system as a whole, can live, without the action of self-destroying inner conflicts.” (Alexander 1979, p.316)

In short, “It is the structure and the content of the language which determine the design.” (Alexander 1979, p.260). And, “The individual buildings which you make, will live, or not, according to the depth and wholeness of the language which you use to make them with.” (Alexander 1979, p.260). This underscores Alexander's emphasis on the importance of the relationships and structure between the patterns in pattern language.

Furthermore, Alexander emphasizes that in a pattern language, there is a nested condition where smaller-scaled things are contained within larger-scaled ones, as follows:

“When every pattern has its principal components given by the smaller patterns which lie immediately below it in the language, then the language is complete. And you see then what a beautiful structure a pattern language has. Each pattern is itself a part of some larger pattern ---- it is born out of these larger patterns through the forces which occur there, and the conditions which allow these forces to be in harmony. And each pattern itself gives birth to smaller patterns which, once again, through forces which must also be in harmony, gives birth to smaller patterns again created by the conditions which put the lower level forces into harmony.” (Alexander 1979, p.322)

This multilayered structure not only reflects the nature of the world but also has significant implications in supporting design. Alexander sees design not as a combination of parts but as a differentiation of the whole, and states:

“In short, each part is given its specific form by its existence in the context of the larger whole. This is a differentiating process. ... In the process of differentiation, the whole gives birth to its parts. ... The form of the whole, and the parts, come into being simultaneously.” (Alexander 1979, p.369-370)

And he states, “In this new vision, it is always the whole, the wholeness as a structure, which come first. Everything else follows from this wholeness ...” (Alexander 2002, p.87-88).

While inheriting Alexander's concept of the relationship between the whole and parts, we have focused on crafting a concise yet deep structure of relationships in our pattern languages of practices, which differs from the complex network he envisioned, as shown in the next section. This approach results in a system with a simple structure, making it easier for readers to understand, remember, and handle. Moreover, in crafting pattern languages of practices, instead of representing everything as patterns with inclusive relationships of various scales, as Alexander suggests in a pattern language of places, we set categories and groups, and explicitly display the structure.

These categories and groups are named, but their contents are often not described in pattern format, although in some pattern languages, categories and groups are also treated as patterns. The reason for this style is that in architectural design, the only sequence is the scale of space, but in the case of practice, in addition to this, there is a sequence of temporal development. Therefore, we represent the scale from the whole to the parts by structuring categories and groups, and incorporate the sequence of temporal development of patterns into their arrangement, expressing both aspects. Specific examples of this will be introduced in the following section.

3. EXAMPLES OF SYSTEMS IN PATTERN LANGUAGES WE CRAFTED

One of the best examples of a pattern language system would be *Words for a Dialogue* (Iba, et al. 2017, Nagai et al. 2017, Iba and Nagai 2018). *Words for a Dialogue* is a pattern language for resolving problems based on an Open Dialogue approach; This pattern language helps to understand the inside of the **Experienced World** of a person with a problem, encourages those involved in the dialogue to express their voices fostering **Various Voices** in the space, and helps to reach a **Co-Created Understanding**. The overview of this pattern language is as shown in Figure 3.

Patterns No. 1 through No. 3 constitute the main parts that make up the whole, and fulfilling these three parts can be broadly considered as achieving the objective of the practice. These three parts are then put into practice through nine concrete actions. In practicing dialogue, the first thing to be aware of and keep in mind is the large scope of the patterns, which are 1. **Experienced World**, 2. **Various Voices**, 3. **Co-Created Understanding**. Then, when practicing each of these patterns, the nine patterns below, which specify the context in more detail, come into place.

In this system, broader patterns encompass more specific ones—for example, the lower levels of the 1. **Experienced World** patterns include 4. **As a Living Person**, 5. **Deep Listening**, 6. **Exact Same Words**, 7. **Open Question**, 8. **Pause for Thinking**, 9. **Response to What is Said**, 10. **Inner Viewpoint**, 11. **Tunnel of Emotion**, and 12. **Respectful Mind**. The nine patterns for practicing the Experienced World pattern are described in *Words for a Dialogue* (Iba and Nagai 2018) as follows:

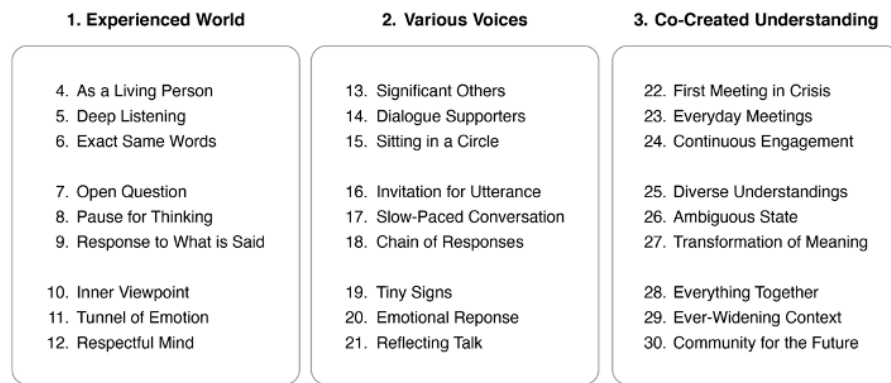


Fig. 3: Overview of the pattern language, *Words for a Dialogue* (Iba et al. 2017, Nagai et al. 2017, Iba and Nagai 2018).

Feel the Experienced World

Understanding how a person with a problem perceives the world and their experiences is achieved through dialogue. The experiences that led to their perspectives can also be understood by listening to their story.

To truly grasp their **Experienced World**, engage with them **As a Living Person** rather than merely in your role, employing **Deep Listening** to comprehend their words, and responding using their **Exact Same Words**.

Instead of 'Yes or No' questions, **Open Questions** must be asked so that they can freely express their thoughts and feelings. It is important to give them a **Pause for Thinking** especially when discussing things that they have not yet been able to put into words. When they share their thoughts, it is crucial to provide an appropriate **Response to What is Said**.

To truly understand their **Experienced World** rather than just knowing their situation, it is necessary to see it from their **Inner Viewpoint**. Their pent-up emotions may overflow, but you should understand that it is a **Tunnel of Emotion** that helps them express their deeper feelings that they have been unable to express in words. In such a case, you should show your **Respectful Mind** for the fact that they have endured difficult situations and help them to express their feelings in words.

Accordingly, you can gradually deepen your understanding of the other person's **Experienced World**.

These nine patterns are also not randomly mixed, but the relationships between the patterns are woven from their contents. In this way, these nine patterns are divided into three groups. Thus, these groups belong to 1. **Experienced World**. In this pattern language, to avoid a complicated structure, the groups at the middle level are deliberately not made into patterns but rather as just cohesive groups. This decision was made because the users of this pattern language, i.e., the book's readers, are the public, and a complex structure may confuse them or discourage them from reading and practicing it.

In *Words for a Dialogue*, categories are described as patterns, No. 1 - 3, but there are pattern languages where neither categories nor groups are treated as patterns. In the *Online Education Patterns* (Hayashi et al. 2021, Adachi et al. 2021), for example, neither categories nor groups are patterns. However, there, the overall concept **Redesigning for Online Learning** representing the whole is described as pattern No. 0 (Figure 4). Such cases, where No. 0 is treated as a pattern, are often found in our pattern languages.

In the pattern languages we crafted, we determine for each work whether to use broader concepts such as patterns, that is, whether to describe them as sentences in the form of Context, Problem, and Solution. As a result, categories and groups are often not described as patterns. Even when not in pattern format, categories and groups are named and defined to delineate the whole from the parts. In this way, we have applied Alexander's ideas, considering the practical aspects.

0. Redesigning for Online Learning



Fig. 4: Overview of the pattern language, the *Online Education Patterns* (Hayashi et al. 2021, Adachi et al. 2021).

Additionally, we have crafted a pattern language with more deeply layered structure, for instance *A Pattern Language for Value-Creation Marketing* (Iba et al. 2020a, 2020b, 2020c). In this pattern language, nine patterns stem from the core pattern that makes up the whole, and each pattern has several action patterns that are subordinate to it (Figure 5).

Another example with multiple layers is *A Pattern Language for Creating Pattern Languages* (Iba and Isaku 2016). It comprises 364 patterns organized into five levels, with each level's elements described as patterns (see Figures 6 and 7).

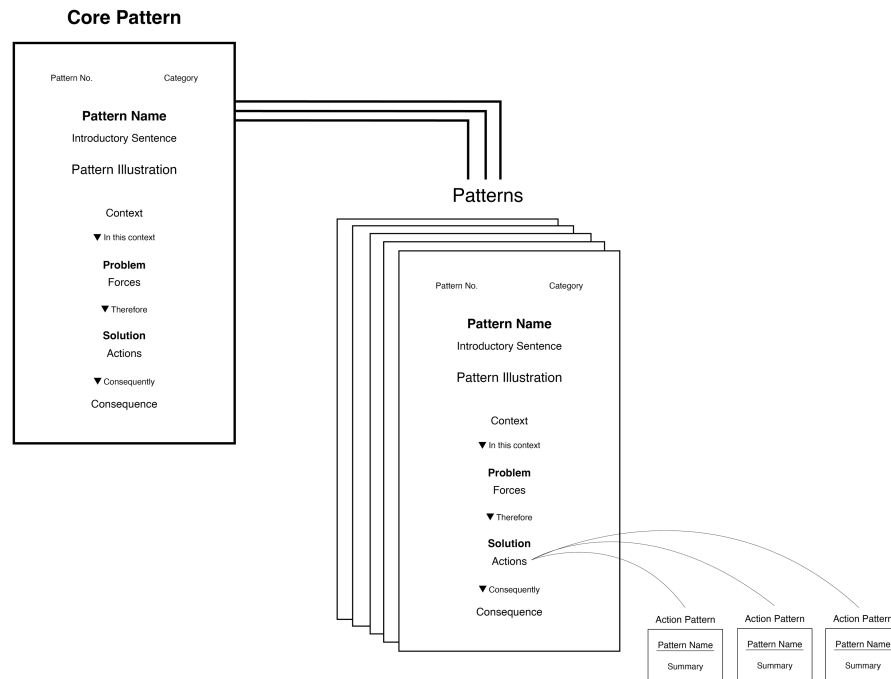


Fig. 5: Layered structure of *A Pattern Language for Value-Creation Marketing* (Iba et al. 2020c).

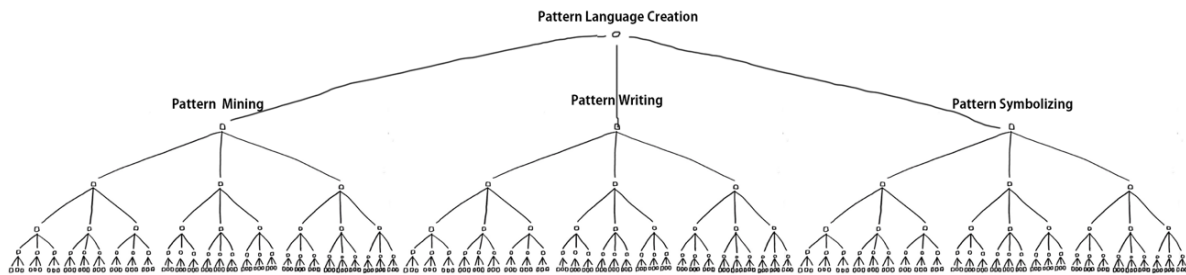


Fig. 6: The overall structure of *A Pattern Language for Creating Pattern Languages* (Iba and Isaku 2016).

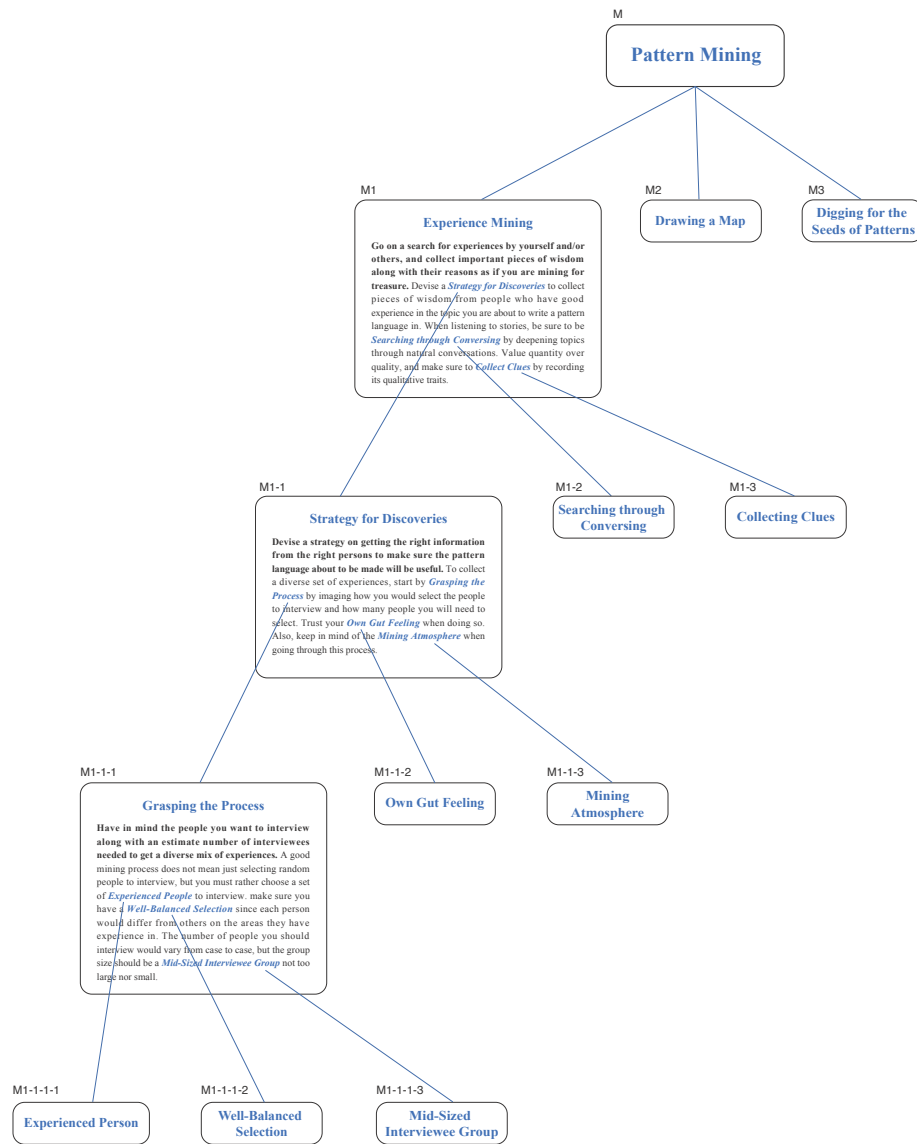


Fig. 7: Examples of patterns in the layered structure below the core pattern, **Pattern Mining** in *A Pattern Language for Creating Pattern Languages* (Iba and Isaku 2016).

Drawing from these experiences, we have concluded that crafting a pattern language with many layers, where each pattern described in the form of Context, Problem, and Solution is best suited for professionals in specialized fields. This is because the various levels of wording the pattern are necessary and effective in professional practice and communication.

On the other hand, especially when the users (readers) of the pattern language are not professional experts but ordinary people, it makes sense to keep the overall number of patterns small and to reduce the cognitive and learning costs. This can be done by only presenting the elements of all levels as category or group names rather than describing them as patterns.

In any case, the work of "systematization" is essential when creating a pattern language to make it a single systematic language rather than just a random collection of patterns. Unfortunately, however, although Alexander conducted such work, he does not explicitly discuss how to systematize them into a language. Therefore, we have been developing and refining our method of systematization in our practice of crafting a pattern language by ourselves.

After more than ten years of experience, we have finally settled on a method. In the following section, we will introduce our way of systematization.

4. THE PROPOSED METHOD OF SYSTEMATIZATION OF PATTERNS

The method of systematization of patterns, which we propose here, comprises three phases as follows: In the first phase, identify three main parts that constitute the whole of good practice and classify 'pattern ingredients' into these main parts; in the second phase, identify three sub-parts for each main part and classify pattern ingredients into the sub-parts; and in the third phase, craft three 'pattern seeds' from pattern ingredients for each sub-part, determine their order, and write a summary of their essence.

Delving into more detail, the steps for each phase are as follows (Figure 8): In the first phase, (1) skim through all the pattern ingredients, (2) identify three main parts that constitute the whole, and (3) classify the pattern ingredients into the main parts; in the second phase, (4) skim through the pattern ingredients for each main part, (5) identify three sub-parts for each main part, (6) classify the pattern ingredients into the sub-parts; and in the third phase, (7) craft pattern seeds from pattern ingredients for each sub-part, (8) determine the order of pattern seeds, and (9) write the essence of the pattern seeds.

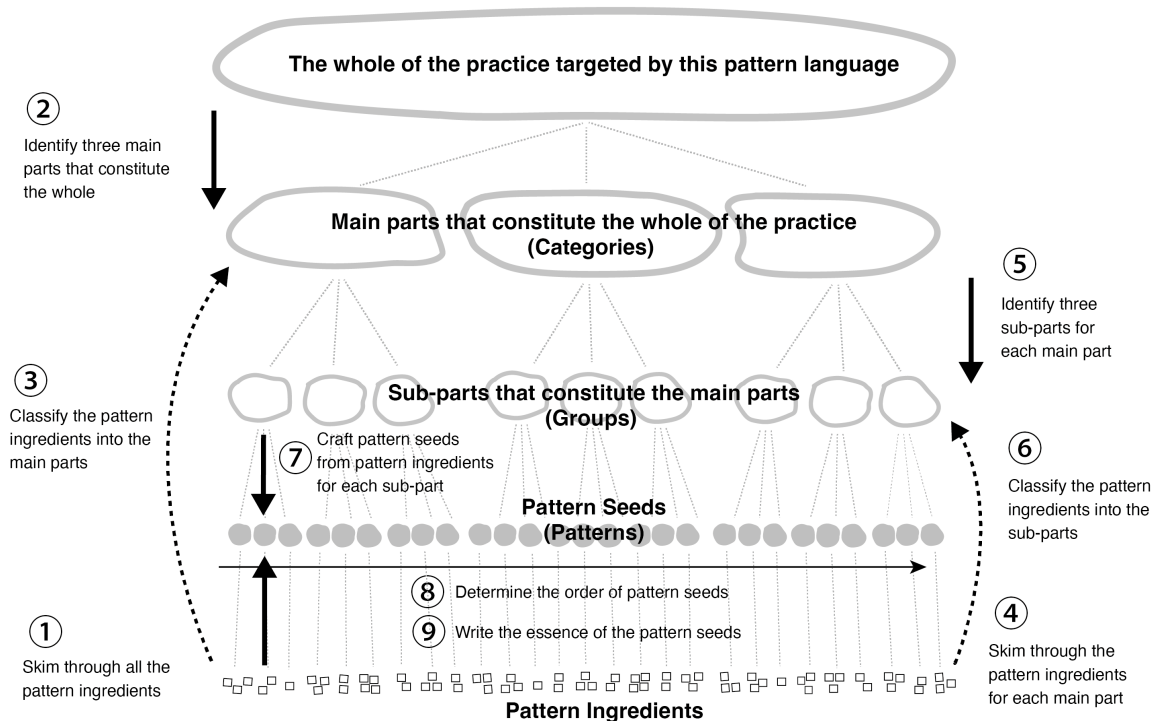


Fig. 8: The overview of the process of systematization.

Note that systematization, a part of the crafting process of a pattern language, is best conducted with a team rather than alone to eliminate subjective biases. In the team, at each stage, each member introspectively reflects, articulates their thoughts to others, and engages in discussions to validate these thoughts.

When aiming for a total of about 30 patterns, at this stage the pattern ingredients often amount to around 60 to 120. These pattern ingredients are those gathered through clustering. In such cases, this process typically takes about 8 to 10 hours, although this may vary depending on the individual's experience with systematization.

4.1 Identifying Three Main Parts that Constitute the Whole and Classifying Pattern Ingredients into the Main Parts

The first phase of systematization of patterns is conducted as follows (Figure 9): skim through the pattern ingredients; feel the good practice as a whole; think of three main parts crucial for generating its quality; share ideas on what could be the three main parts and discuss them; and classify the pattern ingredients into the three main parts.

To begin with, skim through the content of all pattern ingredients obtained from the Pattern Mining, broadly grasping what they suggest about the various aspects of the nature of the targeted practice. Then, with an implicit understanding of these insights, shift the perspective to focus on the entirety of the practice, identifying the three main parts crucial for generating its quality.

At this time, a clear change in your mindset is necessary because you will switch your perspective to feel the whole entirety of the good practice from the many individual ingredients. Simply categorizing groups from the bottom-up method is not enough because while they may summarize the parts well, it often lacks clarity and does not appear to grasp the essence of the three main parts when viewed as a whole. In other words, they are likely to be elusive and unimpressive (not conveying a message). Therefore, in this top-down stage, the focus of thought should be on clarifying the three essential aspects of the whole (while considering the parts).

As mentioned before, systematization should ideally be conducted by a team rather than by one person's biased perception, aiming to craft a system based on mutual understanding. However, in identifying the three main parts that represent the whole, it is effective for individuals to think independently and then share their ideas in the team, starting the discussion from there. During these discussions, the focus should not be on selecting a specific answer, but rather on exploring and confirming the different perspectives and possible ideas of the three parts. After this, each member should take time to reconsider individually, then share and discuss again. Through this process, a consensus usually forms, and the appropriate three parts become clear. In this way, we find the right composition of the three parts, not through compromise or blending, but by strongly feeling 'this is it'.

After identifying the three main parts, it is essential to evaluate and adjust these parts to ensure they collectively cover all necessary aspects to enhance the overall quality of the practice. The three parts must not only be contained within the whole but should also be sufficient to cover the whole (Figure 10).

After identifying the three main parts that make up the whole, the next step is to classify the numerous pattern ingredients according to which main part they belong to. On a large sheet of paper, write the phrases for the main parts on separate sticky notes and place them in three distinct areas. Then, place related pattern ingredients beneath them. At this stage, don't worry about aligning them neatly; focus solely on dividing them according to which main part they belong to, leaving the relationship and arrangement of ingredients within the same part arbitrary. This process is to ensure that all pattern ingredients can be classified under the contents of the three main parts.

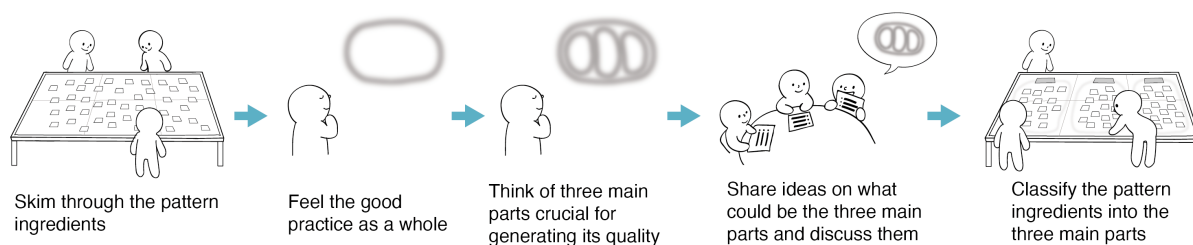


Fig. 9: Identifying the three main parts that constitute the whole and classifying pattern ingredients into the main parts.

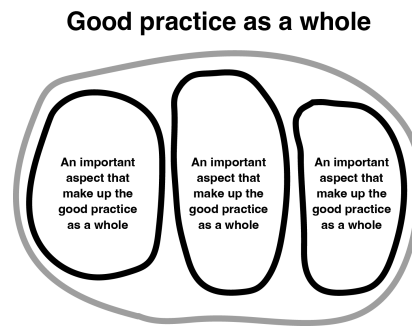


Fig. 10: Considering the three main parts that constitute the good practice targeted by this pattern language as a whole.

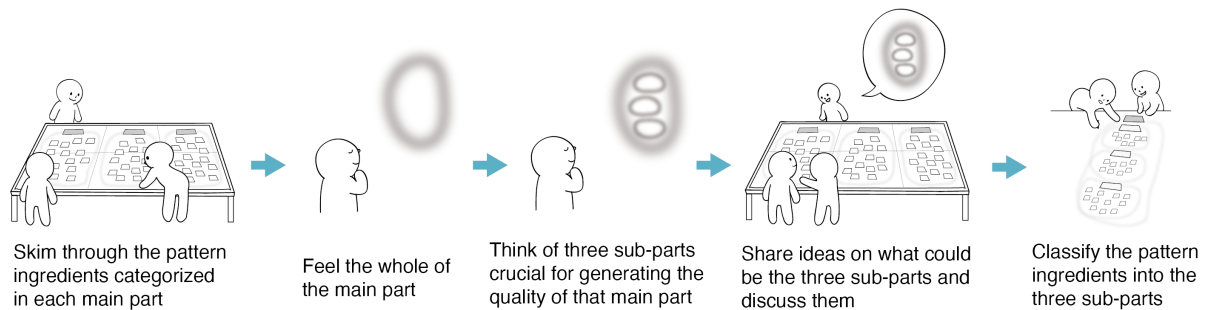


Fig. 11: Considering the three sub-parts that constitute the whole of the practice targeted by this pattern language.

If a reasonable number of ingredients end up under each main part, even if they are not evenly distributed, it is considered satisfactory, and you can proceed to the next step. However, if there are hardly any ingredients under a particular main part or if the number is sparse, it may indicate that the direction of that main part is not correct. In such cases, use these results to reassess the three main parts that constitute the whole.

4.2 Identifying Three Sub-Parts that Constitute each Main Part and Classifying Pattern Ingredients into the Sub-Parts

The second phase of systematization of patterns is conducted as follows (Figure 11): skim through the pattern ingredients categorized in each main part; feel the whole of the main part; think of three sub-parts crucial for generating the quality of that main part; share ideas on what could be the three sub-parts and discuss them; and classify the pattern ingredients into the three sub-parts.

To begin with, focus on one of the three main parts and skim through the content of the pattern ingredients that belong to this main part. Then, while keeping this in mind, think about the three sub-parts that are essential for realizing this main part. The approach is the same as when considering the three main parts that make up the whole. Differentiation from the part is easier than differentiation from the whole because the content is more concrete, so after allowing some time for individual thinking, the person who comes up with a good idea speaks first, followed by a discussion among everyone. Once the three key sub-parts of this main part are identified, that main part is temporarily complete, and then you move on to the next main part.

After considering the three main parts, the final step is to check whether each of the sub-parts effectively covers and sufficiently represents its corresponding main part. If there are parts that do not fit well, adjust the content and scope of the sub-parts to ensure a proper fit. Once everything seems to fit together well overall, this step is complete.

After determining the three sub-parts within each main part, the next step is to classify the pattern ingredients according to the sub-parts they relate to. The approach is similar to how the pattern ingredients were classified into the three main parts. If the ingredients are distributed in a balanced manner across each sub-part, it is considered satisfactory. However, a sub-part with few or no ingredients will require reevaluation.

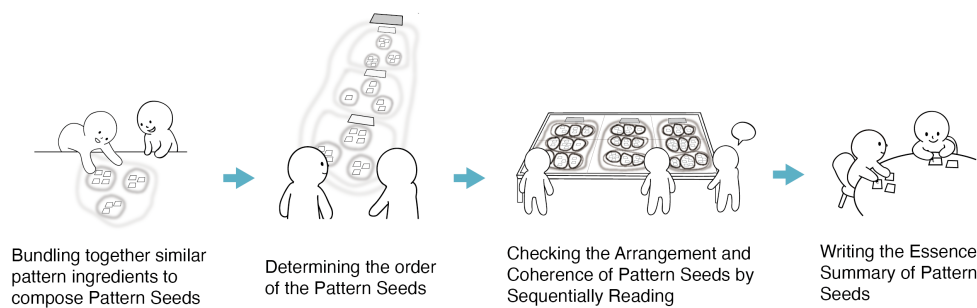


Fig. 12: Determining the order of the pattern seeds, checking the arrangement and coherence, and writing the essence summary of the pattern seeds.

4.3 Crafting Three Pattern Seeds from Pattern Ingredients for Each Sub-part, Determining Their Order, and Writing Their Essence

The third phase of systematization of patterns is conducted as follows (Figure 12): bundle together similar pattern ingredients to compose pattern seeds; determine the order of the pattern seeds; checking the arrangement and coherence of pattern seeds by reading them sequentially; and write the essence of the pattern seeds.

Here, aim to develop three pattern seeds for each sub-part. While envisioning the three essential aspects needed for the sub-part, compile the related pattern ingredients. Group together ingredients that are similar in meaning or seem to belong to the same pattern. Craft each pattern seed so that it consists of one or more pattern ingredients. The components at this stage are referred to as pattern seeds, though they are distinct unities, they have not yet fully developed. They possess the potential to further develop and mature, therefore the term 'seed' is appropriate. In this sense, pattern seeds should be viewed as either 'potential patterns' or 'hypothetical patterns.'

Absorb relatively weaker ingredients or those that are too specific compared to others into a pattern seed with similar content. In this way, craft just three suitable pattern seeds for each sub-part. If a group ends up with four or five strong and significant pattern seeds, consider merging them within the sub-part, or moving and integrating them with seeds in neighboring sub-parts. Remember, the surrounding sub-parts belong to the same main parts and can be shifted by adjusting the definitions of the sub-parts. Occasionally, by shifting the emphasis of the meaning of a seed or ingredient, it might be more appropriate to place it in a different main part. Thus, by making both partial and holistic adjustments, aim to neatly fit everything into the overall structure.

At this stage, each sub-part comprises just three pattern seeds. Let's introduce the terminology for systems of pattern languages: 'main part' as 'category' and 'sub-part' as 'group'. The choice of these terms depends on the perspective. From the viewpoint of the whole, 'main part' and 'sub-part' are used to describe its components. Conversely, from the perspective of pattern seeds, 'group' is used to describe a collection of pattern seeds, and 'category' for a collection of groups. As the pattern seeds are now incorporated into the system, we can adopt the perspective of 'groups' and 'categories.' Going forward, we will use the most suitable terminology based on the context and situation. It should be understood that 'main part' is synonymous with 'category', and 'sub-part' with 'group'.

Next, consider the order of the three patterns within each group. Patterns, when presented, are arranged sequentially and therefore have a specific order. This order is not determined arbitrarily. We consider the order of patterns within a group based on the following policy:

The first pattern in the group is usually the most straightforward, important pattern of the group and is representative of the group (Figure 13). If the less important or distinctive pattern comes first, the whole group will seem insignificant. Hence, it makes sense to place the important ones that carry more of an influence first. Otherwise, the order is based on the inherent logic of the patterns themselves.

The last pattern of the group is also unique because they are challenging to apply and implement, or it is a distinctive pattern that occurs less frequently than others. If there is such a pattern in the first or second place, it will be challenging to continue with the following pattern.

Accordingly, the first and last patterns of the group are distinctive. On the other hand, the second pattern is less peculiar and versatile. In most cases, the order of the second pattern is decided after the first and third are determined. The second pattern is not introductory, nor is it too difficult or exceptional; it is just a typical pattern.

However, it may be a pattern that is a bit deeper than the first or a pattern that comes later in terms of time or experience than the first pattern.

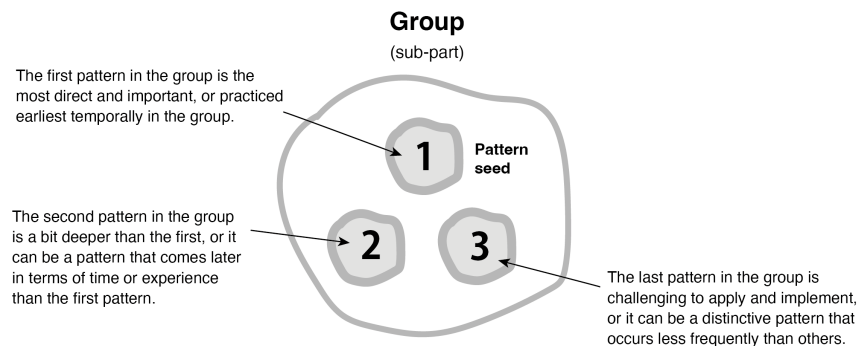


Fig. 13: Basic policy to determine the order of patterns in a group.

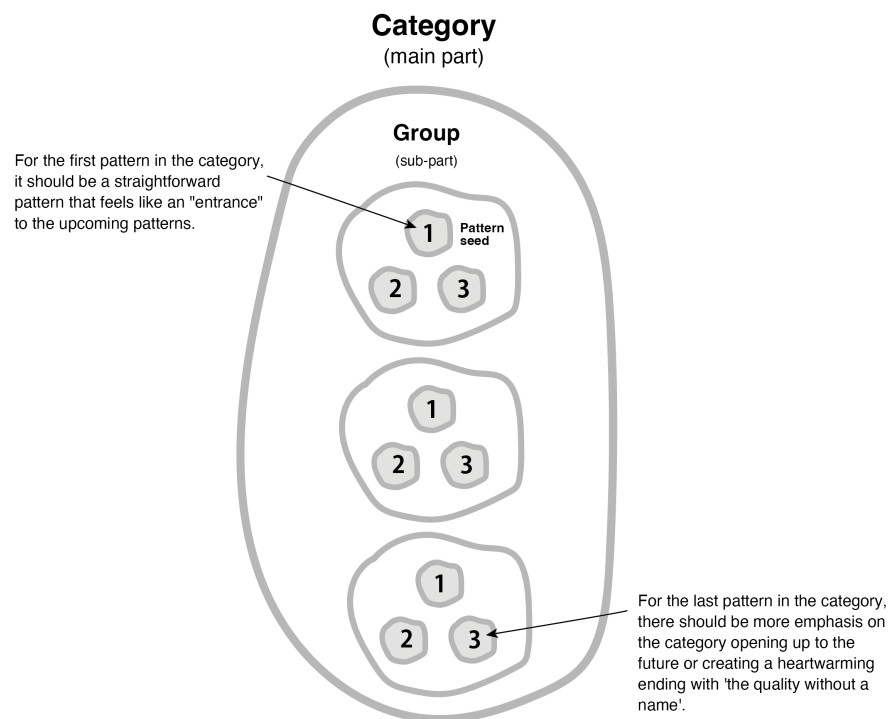


Fig. 14: First and last patterns in each category.

Also, from a broader perspective, certain aspects need to be considered at the beginning and end of a category (Figure 14). Ideally, the first pattern in a category should be introductory, containing primary contents, as it is the first pattern the reader encounters. If the first pattern abruptly takes a random direction, it may confuse the reader. The first pattern should be straightforward, serving as a “entrance” to the subsequent patterns. Therefore, carefully consider the first pattern, and if necessary, rearrange the group order to ensure it serves as an effective introduction.

The final pattern in a category should leave a strong impression, signifying the conclusion of the patterns. Hence, the last pattern must be forward-looking or heartwarming. The third pattern in each group is generally either difficult to apply or less common than others. However, in the final group of a category, the emphasis should be on whether it suggests a future perspective or evokes warmth. This approach ensures a coherent and impactful end to each category.

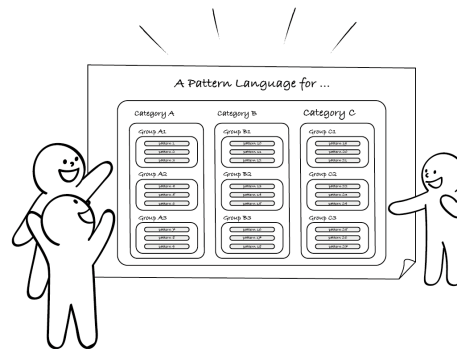


Fig. 15: Completion of the system of a pattern language.

Upon completing the system, verbally explain its contents and reconsider any parts that do not make sense or fit well. Then, demonstrate how the patterns can be achieved by interrelating them, thus crafting a system of patterns. If necessary, adjust any details that seem misaligned or out of context. This explanation can be a self-check, done alone or with other project members and external personnel.

For instance, explain in this way: "To accomplish the goal of this pattern language, these three major factors (categories) are important: A, B, and C. To achieve A, it is important to focus on A-1, A-2, and A-3 (groups). For implementing A-1, the best approach is to execute A-1-1, A-1-2, and A-1-3 (patterns)."

Should the system lack proper organization, questions such as "Why is this category, group, or pattern here?" may arise. This indicates a need to revisit that part. Sometimes, revisions may be confined to a specific part, but they can also impact the entire pattern language. In any case, it is crucial to repeatedly review the categories, groups, and patterns, and make necessary corrections until achieving satisfaction with a good-quality pattern language.

Finally, write a one-sentence summary capturing the essence of each pattern seed obtained as a result of the systematization. These summaries often resemble the solution statements of a pattern descriptions, occasionally starting with contextual phrases like 'In situations such as ...' or 'When ...'. These summaries lay the groundwork for subsequent Pattern Writing. Thus, the phase of systematization is completed (Figure 15).

5. DISCUSSION: WHY DIFFERENTIATE INTO THREE?

In the proposed method of systematization, we organize a pattern language into three categories or groups, each consisting of three patterns, as three is an optimal number for crafting a harmonious and comprehensive system. While two items might limit the scope and diversity of perspectives, four or more can complicate the structure, making it less intuitive to grasp. In contrast, three maintains a balance between simplicity and complexity, an ideal middle ground that avoids over-simplification or unnecessary complication.

The significance of the number three is not arbitrary but deeply rooted in various cultural and historical contexts. It is evident in the Holy Trinity in Christianity, the three primary deities in Hinduism, and the tripartite soul structure in Plato's 'Republic'. This symbolism extends to the arts and literature, notably in the structure of trilogies and three-act plays. Moreover, the rock-paper-scissors game and the proverb 'Three heads are better than one' highlight its practical relevance. The dialectical process and tripartite divisions further exemplify this number's universal application. Philosopher Charles Sanders Peirce also recognized the power of three, structuring his philosophical and methodological frameworks such as deduction, induction, and abduction. Even in physics, the three-body problem illustrates the dynamic complexity that emerges from triadic interactions.

By focusing on the number three, we can craft cohesive, well-structured system. This approach also ensures a balanced distribution of content within the pattern language, avoiding the pitfalls of having too many or too few elements. Moreover, it simplifies the reader's understanding and application of the pattern language. Therefore, our method deliberately adopts this triadic structure, recognizing its historical significance and practical utility in organizing complex systems.

While our fundamental approach is to organize into three groups, we adapt the number of groups within each category based on specific needs. For example, in the *Online Education Patterns* (Hayashi et al. 2021, Adachi et al. 2021), as shown in Figure 4, we faced many significant patterns. Therefore, we structured four groups within each category to accommodate them. In another case, *Active Learning Patterns for Teachers*, we have expanded

to five groups per category, resulting in 45 patterns in total (Iba and Utsunomiya 2018). However, we observed that such a large number of patterns can be overwhelming and challenging for readers to memorize, affecting the practicality of the pattern language. From the experience, we learned that it is important to keep three in order to make a pattern language simple.

6. CONCLUSION

In this paper, we introduced a previously undiscussed method for pattern language systematization, developed and refined through our research and practice. We hope that this paper's contents will aid those engaged in crafting pattern languages in the future.

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