

Revealing, Communicating, and Sharing Experiential Knowledge of Expert Groups

Unleashing the potential of pattern languages for knowledge transfer

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ABSTRACT

The authors describe their project of developing a pattern language for knowledge transfer in organizations. The group of experienced knowledge transfer facilitators aims to reveal and articulate their own in-depth experience, allowing others to utilize that knowledge. The key success factors for preserving and passing on the group's experience are explained in detail, with the help of a simple practical example. This article presents the formal structure of the pattern language and the phases of its development, with a particular focus on shared values among group members. The emphasis is on collaboration based on dialogue and experience, and the use of digital tools to support pattern language development is also highlighted.

The group's conclusion is a clear call to approach experiential knowledge sharing through the development of pattern languages. Their pattern language development not only makes the group's mutual experience in the field of knowledge transfer visible to others but also creates a unique form of collaboration that greatly enriches the expertise of the entire group and the results of their work. They engage in experience-based, dialogical reflection and work collaboratively to process individual experiences into collectively validated recommendations. Additionally, the creation of a pattern language leads to a more precise technical vocabulary. Pattern languages can surpass many traditional knowledge management methods and tools in terms of sharing and passing on experiential knowledge within groups.

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1 Starting with curiosity about experiential knowledge

Many book lovers know the feeling of opening a book and being completely captivated after just a few pages. Similarly, two experts with decades of experience in knowledge management share a passion for their favorite topic. Their vision is to extract their collective knowledge and make it accessible to future generations in an appropriate form.

Both also share an interest in the lean yet intricate concept of a pattern language developed by Christopher Alexander et al. (1977). Pattern languages are similar to maps that guide the way through unexplored areas. They interweave individual building blocks of knowledge (called patterns) like a network of interconnected elements to form a tapestry of knowledge. The two experts recognize that this concept could help them share their decades of practical experience in the field of knowledge management. They decide to develop a pattern language on knowledge management.

In the following weeks and months they struggle to find a suitable way for developing their pattern language. They quickly realize that attempting to condense the vast field of knowledge management into a pattern language would present significant difficulties. As a result, they narrowed their focus to the sub-area of knowledge transfer, *i.e.*, knowledge sharing, which is relevant to many organizations.



Fig. 1: Our vision is to extract and reflect on experiential knowledge

During the initial stages of pattern language development, it becomes clear that comprehensible and useful insights cannot be formulated alone. Therefore, it is essential for at least two experts in the relevant field of knowledge to engage in a dialogue, sharing their experiences and the particularities and variations of the situations in which they are made. Fruitful cooperation leads to a deep understanding of pattern language development. The experts alternate between discussing the pattern language as a whole and focusing on individual patterns, gradually navigating the complexity with growing confidence and finding a clear path through the labyrinth of knowledge elements.

After a period of time, the group has acquired three additional members. Now coming from three different countries, they primarily communicate online and share their findings. Their common interest

lies in the fascination of pattern language development and its ability to uncover and reflect on their own experiential knowledge. They move from specific details to general insights, exploring individual experiences and reflecting on them together. They approach the essence of their experiential knowledge through an oscillating, almost rhythmic motion.

The resulting pattern language extends beyond a mere collection of narrated stories. It provides a framework for the collective insights and experiences of the group. Many people tell stories, but only a few dare to transform these experiences into pattern languages.

Their pattern language is fascinating because it reveals valuable treasures that may not be immediately apparent. The experts work together to uncover and organize these treasures, experimenting with various methods and tools, and using different software to document and organize their experiences.

A specific type of dialogue within the group is crucial for gaining insight. It facilitates a smooth path despite significant thematic challenges. The entire group acknowledges the value of diverse perspectives and realizes that considering more than one option provides greater inspiration than limiting oneself to either/or when discussing different experiences. While working together, they develop a shared vision that their pattern language will be a legacy for future generations. The richness of its meaning continuously drives and motivates them.

The experts refine their experiential knowledge and progress from narratives and anecdotes to patterns and a pattern language. They extract, structure, and document patterns to distill the essence of their collective knowledge. This is an iterative process that oscillates between content and structure, knowledge and experience. To navigate the information flood, they seek ways to visualize their ever-expanding knowledge map.

As the group develops and explores their pattern language, they realize that apparent contradictions can be resolved through respectful cooperation. Conflicts of interest and battles for power have no place in the group, because although they have very different personalities, they are united by a common value system. They willingly share their best experiences because they know that this leads to remarkable results. They understand that their journey involves not only developing a pattern language but also learning how to do so.

In the field of knowledge management, a group of experts has developed a promising approach: the use of a pattern language to make diverse experiential knowledge visible. This report summarizes their best methodological findings and provides guidance for exploring the limitless possibilities of pattern languages and unleashing their power.

2 Developing a pattern language through dialogue and iteration

2.1 Defining the meaning and purpose of a pattern language

When explaining the methodological approach, it is important to focus on the end goal of having a pattern language. This will help to clarify the necessity of each step in the process. The ultimate aim is to create a pattern language that accurately reflects the knowledge and experience of a specific field. This pattern language should be user friendly and effective in solving problems and challenges within the relevant field.

Imagine a group of friends who are passionate amateur chefs. After decades of experience, they want to record their personal insights into the preparation of dishes, the balancing of flavors, and the variations of international cuisines. They aim to document their extensive experience, which cannot be found in any cookbook worldwide, in the form of a pattern language. This documentation will serve as

a source of knowledge and inspiration for others, particularly their children and grandchildren.

Therefore, the pattern language should be application-oriented, comprehensible, and provide a thorough overview of the field of knowledge. This requirement for comprehensibility implies that the text should be concise, clear, and to the point. In other words, short recipes with keyword-like lists of ingredients are easier to understand than long descriptions in prose. However, the pattern language should be detailed enough to cover scenarios, situations, contexts, and procedures in the necessary depth. It should provide possible courses of action and illustrate the connections between the many interlinked fragments of knowledge it contains. Genuine understanding can be fostered by utilizing the pattern language, which includes narrative elements. These experiential stories promote the development of interconnected knowledge and true insight by providing reference points that can be applied when reading and experimenting.

For the cooking enthusiasts, it is important to balance concise recipes and experiential narratives. Checklists of spices can be just as useful as stories about unique experiences, such as a dinner party where it was discovered that not all guests enjoyed Persian cuisine due to the herbs and preparation methods used.

Pattern languages inherently contain a certain degree of complexity similar to experiential knowledge. This complexity arises from the interconnected and interwoven details within them. In the following section, we will explain how to map the complexity of experiential knowledge in the pattern language and how to manage this complexity when applying the completed pattern language.

Requirements for utilizing the pattern language are closely linked to demands for quality, correctness, validity, and reliability of its content. The proposed solutions in the pattern language should effectively solve problems and not create additional difficulties. We will provide tips throughout to ensure the quality of experiences recorded in the pattern language. The culture of cooperation among the pattern language developers plays a significant role in this context.

2.2 Phases of pattern language development

The process is structured and organized by dividing it into phases, which makes the complex method easier to understand. Once individual phases have been completed, the respective results can be checked, and quality assurance steps can be incorporated. These milestones are also useful when deciding at defined points whether to proceed to the next phase or step back to an earlier one.

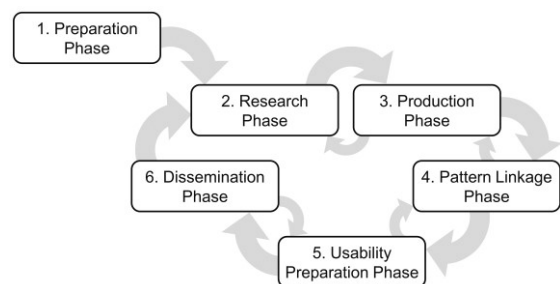


Fig. 2: Phases in the development of a pattern language

It takes both sensitivity and value-guided cooperation in the development group to create a good pattern language. We will therefore go far beyond a purely formal description of the phases. Although a compact overview of the process steps could be summarized in a few key words, it is important for us to dig deep so that we can place a special focus on quality when developing the pattern language. Figure 2 visualizes the sequence of phases in the development of our pattern language: preparation phase, research phase, production phase, pattern linkage phase, usability preparation phase, and dissemination phase.

Temporary focus on individual phases enables efficient use of resources in pattern language development and increases the likelihood of successful completion of the process as a whole. The phases are also a useful tool for assigning responsibilities for individual tasks to team members.

2.2.1 Preparation phase

The preparation phase involves selecting the field of knowledge to be described, the specialist domain, and assembling an appropriate team to develop the pattern language. The group should consist of experienced, highly knowledgeable people who have actual practical experience in the knowledge domain. This can quickly add up to several decades of practical experience. All participants should share the goal of creating a pattern language of their knowledge. The pattern language should contain tried-and-tested solutions to common challenges in the group's area of expertise and be suitable for passing it on to practitioners in the field.

Practically proven expertise is one side of the coin when building a team – collaboration and cooperation is the other. A team developing a pattern language can only be successful if each member is willing to engage in open, transparent dialogue and appreciative cooperation. The team must be committed to discovering, reflecting, preserving, and sharing its experiential knowledge. When it comes to formulating solutions together and reflecting on knowledge in the pattern language, people need to talk about their own personal experiences. It is often necessary to question findings, to approach each other in the formulation of texts, and to deal constructively with contradictions and differing attitudes. Not all people – and certainly not all experts in a field of knowledge – are eager to engage in such dialogue. It is therefore important to ensure from the outset that the team developing the pattern language is willing and able to work together as partners.

Let's take a look at our cooking experts: they want to share their knowledge at an advanced level, avoiding repetitive discussions of basic concepts such as the necessity of adding a pinch of salt to every sweet pastry. Assembling a team of experts is therefore essential. However, expertise is not the only requirement. When it comes to cooking, success can be achieved through various ways. And often it is not a question of which way is better, but rather of bringing together and comparing different approaches. The group overcomes the typical assertiveness of discussions and discovers the opportunity that lies in an open and appreciative approach to diversity. This team does not engage in the usual arguments about whether to salt meat before or after roasting. Everyone has the opportunity to share their positive and negative experiences, and everyone accepts the experiences of others without reservation.

Especially at the beginning of the group's work, it is necessary to have at least one person with special expertise in pattern languages and their development. This methodologically experienced team member has the important task of first communicating the principle of pattern languages to the team. Special importance should be placed on explaining the uniqueness of pattern languages. It should be emphasized how the development of a pattern language can uncover the essence of the experiential knowledge of several people in an extraordinary way and prepare it for others to apply. In this way, experiential knowledge becomes manageable for others.

Pattern languages are developed dialogically in the method presented here. They bring together different worlds of experience and personal influences without imposing individual points of view through persuasion or debating rhetoric. The team members learn as they build the pattern language, benefiting from the tremendous gain in knowledge that comes from working together and reflecting on their shared experiences. They capture the essence of their personal experience and create a lasting record of their knowledge.

During the development process, the method expert ensures that the group consistently follows the process steps and adheres to the defined standards. If the required methodological expertise is not available initially, it can be acquired during the process by consulting relevant supporting literature, such as this article and examples of pattern languages from other domains (see Grundschober 2018, Gamma et al. 1994, Bauer 2014, Iba et al. 2016, InterQuality Architekten 2018).

Even more important in the preparation phase is the definition of the domain to be worked on. Together with the formation of the team, this is an iterative process step. On the one hand, the domain somewhat defines the appropriate specialists for the development team; on the other hand, the team must then decide exactly which areas of expertise should be the subject of the pattern language. For example, the team that wants to write the pattern language about cooking may realize early on that this topic, with all its facets, is too broad and partly outside the team's area of expertise. They might then decide to narrow the domain, for example to vegetarian cooking. The iteration here is that the specification of the content, *i.e.*, the definition of the sub-domain, may lead to the search for other team members who were not previously considered.

2.2.2 Research phase

The actual development of the pattern language begins with the research phase. The team meets in workshops, dives into the defined domain, and searches for topics that could potentially become patterns. The team members share their experiences and insights with each other. Of particular interest here are approaches that have repeatedly proven successful in everyday work, *i.e.*, procedures that have been proven to be robust and tried and tested.

Our professional chefs talk about their different strategies for cooking vegetables to perfection. From the influence of piece size when cooking, to slow heating in the oven, to the precise timing of roasting different varieties, they share ideas and even learn from each other.

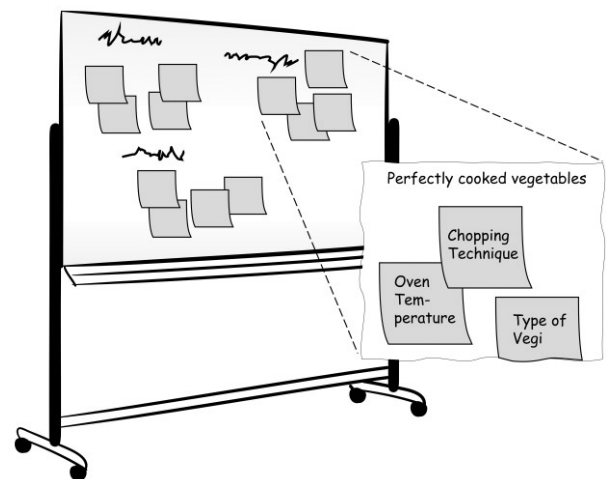


Fig. 3: Collecting and clustering experiences

Stories, questions, and additions alternate so that the team members engage in a dialogue similar to a brainstorming session. They briefly note key points that match their own experiences. As is typical in brainstorming, the statements are not initially evaluated or judged. While the team members share their experiences in different situations, they come up with a variety of tried and tested solutions, even for similar problems. Clustering according to appropriate categories (topic areas, solutions, or other structuring features) can take place directly (see Figure 3). When reporting experiences, it is important that their specific contexts are also recorded, *i.e.*, the situations and conditions under which the solutions proved to be successful.

Discussions and debates in professional settings are often characterized by compromise, persuasion, and subordination. It is important

to note that there may not always be one right solution, and all perspectives should be considered. This can lead to a rich exchange of ideas. It is important to avoid letting personal opinions or theoretical models dominate the discussion. The information is about real-life situations that team members have experienced. Unlike decisions or assessments, these experiences are not subject to being right or wrong. They are true and real for those involved, and represent memories of situations where problems were solved, decisions were made, or particular actions were successful.

During the process of gathering topics, concise pre-formulations of text passages are created for patterns. Each pattern is given a name that aptly describes the situation or solution. To provide structure, a standard format is used, consisting of the following sections: context, problem, forces, solution, obstacles, and application examples (refer to Figure 4).

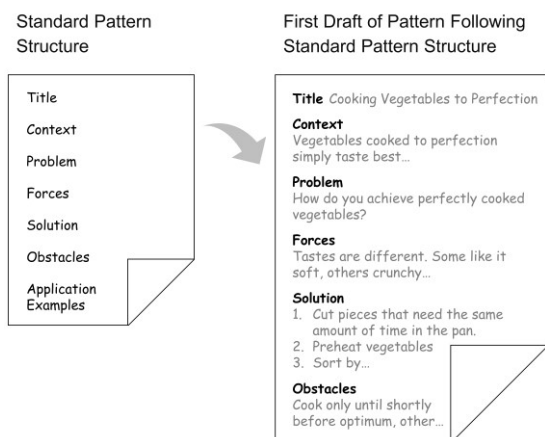


Fig. 4: Standard structure for patterns and sample patterns

In substantive discourse among experts, those higher in the hierarchy or more rhetorically skilled typically prevail. The culture is often one of discussion rather than dialogue, with individuals asserting their own point of view. In the best case, compromises are made. In contrast, our approach aims to eliminate such factors in identifying and formulating patterns.

The recommendation here is to use tolerance and dialogue, rather than discussion, to strive for a variety of patterns and solutions. Developing a pattern language is not about convincing or outdoing each other, but about gaining knowledge as a team. The task of the working group is to share individual experiences, explain them to each other, and form common mental models and formulations.

One of the most significant differences between this form of collaboration and others is the consistent consideration of the participants' diverse experiences. The discourse is grounded in experience rather than assumptions or theory. The team develops general solutions, proceeding inductively, and consciously presents different alternatives next to each other. All perspectives are valid insofar as they reflect the personal experiences of those involved.

The cooking enthusiasts should therefore avoid copying recipes from cookbooks or taking tips from cooking shows and nutrition guides without verifying their accuracy and validity. The group solely describe their personal experiences, tested solutions, and achieved results.

2.2.3 Production phase

The production phase is where the majority of the intellectual work in the development process occurs. The development team convenes as a whole or in smaller subgroups to refine the designs and texts.

At this stage, initial considerations and implementations regarding the presentation, type of illustration, and visualization of the patterns

should be made. If pattern presentation is to be supported later by means of a visual language, one can use characteristic visual elements such as icons, photographs, or a specific color scheme. To provide a brief summary of each pattern, the most important statements can be highlighted or a separate abstract created.



Fig. 5: Using graphic language for visualizing and easily finding patterns

The team developing the pattern language for vegetarian cuisine is considering the use of graphic symbols to indicate spiciness and origin of the dishes. They enrich their instructions, written down in the form of patterns, with this visual language to help users easily identify spicy Thai dishes, for example (see Figure 5).

2.2.3.1 Two strategies for leveraging collective experience

The pattern language should accurately reflect the group's unique experiential knowledge. Thus, the question arises as to how the group can access this valuable knowledge, bring it to light, and uncover any unconscious or tacit components. Two strategies that have consistently proven successful are: a) methodical formal structuring, and b) the formation of a dialogically oriented community of values.

a) Methodical formal structuring

We have had good experience with a standard pattern structure consisting of context, problem, forces, solution, obstacles, and application examples. Other pattern languages use additional sections within the patterns, e.g., consequences, strengths, advantages, disadvantages, tools, or target groups (see Bauer 2014). The structure to be chosen should be based on the domain and be suitable to represent the knowledge structure of that domain.

The hobby chefs decide to include a section on tool handling techniques for each recipe, describing the specific tool handling when processing the ingredients used in the recipe.

The contextual nature of experiential knowledge is worked out in patterns using the standard pattern structure. This is covered not only in the section explicitly named context, but also in the sections on forces and obstacles. When we give advice to others on how to deal with a particular situation, we usually derive it intuitively from our own individual experience. The patterns of a pattern language, on the other hand, contain the knowledge that several team members have gained from many problem situations that they have successfully mastered again and again under certain conditions. Solutions derived from this have a higher probability of success than individual subjective experiences that are passed on as recommendations in the form of anecdotes. Although one of the strengths of experiential knowledge is that it can be used to solve problems in new contexts, there may be changes in conditions that make previous solution strategies inappropriate for new situations. We would like to illustrate this complicated issue by using a simplified example of our hobby chefs:

The group has found that good preparation goes a long way toward making delicious meals. For example, one of their patterns suggests that preparation is easier if all ingredients are peeled, pre-cut to the right size, and portioned before cooking or mixing. This insight is true in principle, but with exceptions. It would be counterproductive

to follow this procedure in *every* case. What are the limitations of this general recommendation? Such conditions for the validity of experience must be specified in the context section. In this case, for example, it would be appropriate to point out that ingredients that quickly become unappealing when cut and exposed to air (e.g., avocados) should not be cut in advance, but only just before mixing with other ingredients.

At times it can be a challenge to follow the standard pattern structure because it is sometimes difficult to clearly separate which statement belongs in which section. For example, a statement about the circumstances under which a particular pattern should be applied may be placed in the context, forces, or even the problem definition sections. Team members may initially have different opinions and come to dissimilar intuitive decisions. It has been found useful to work with guiding questions that make it easier to assign the right place in the pattern structure. Such guiding questions might be

- *Context*: In what situations can this pattern be used? What is the initial situation?
- *Problem*: What question does the solution answer?
- *Forces*: What conditions challenge the basic applicability of the pattern?
- *Obstacles*: What are the barriers to following the solution in the pattern, and what is the best way to overcome them?

The use of a standard pattern structure promotes qualitative work by compelling the development team to delve into their knowledge. However, adherence to the standard pattern structure is crucial for this approach to be effective. While contradictions or differing opinions on the distribution of text across the pattern structure may arise among group members during the development process, such differences of opinion often indicate gaps in perception. More precise guiding questions and a common understanding of the sections may still be lacking.

The optimal structure for patterns in a specialist area and group may only emerge after a certain period of development. It is important for the group to have the freedom and flexibility to modify and change the structure as needed. While a standard structure for patterns may seem daunting at first, its advantages become apparent after intensive work with the patterns.

It is important to be prepared for a dry spell, but overcoming this will lead to fruitful results. For instance, appropriate guiding questions, like those mentioned earlier, can prompt the discussion of aspects that experienced team members may take for granted and would not have considered addressing themselves. This is another crucial challenge when dealing with one's own experience. Developing *sensitivity to what is taken for granted* is a key quality for those involved. This sensitivity can be honed by adhering to the pattern structure and explaining solutions to one another.

b) Dialogically oriented community of values

The second strategy to be pursued in parallel concerns the chemistry of the group itself and its shared values. The requirements for productive collaboration are particularly high when working out the texts in the patterns. It is recommended to start with simple patterns and progress to more advanced and complex tasks as the work progresses. This allows the level of collaboration to grow with the requirements.

The working group collaborates to reflect on individual experiences and consolidate them into shared mental models. Certain attitudes, values, and techniques are necessary to enable this new form of knowledge sharing and enrichment:

- *Dialogue-based instead of discussion-based*: The members listen to each other until they reach a mutual understanding. No attempt is made to convince one another. In cases where

individuals have conflicting experiences and demand different solutions, the principle of ‘this as well as that’ applies. The goal is to understand rather than persuade. All solutions are considered equally valid as they are based on the experience of a community of experts. Individual patterns are developed and refined through collaborative dialogue until the descriptions are clear and applicable for others.

- *Ambiguity tolerance*: To allow for contradictory solutions to co-exist as equally valid, participants in this form of collaboration must possess a high degree of open-mindedness and an understanding of ambiguity. As a result, the complexity of the pattern language increases.
- *Community of values*: The group has a shared set of values, which is crucial for managing the sharing and joint formulation of experiential knowledge. The behavior of the group is characterized by acceptance, respect, and recognition.
- *Experience-led instead of assumption-led*: One important feature that distinguishes this form of collaboration from others is the consistent consideration of the different experiences of the participants. The formulation of patterns follows an inductive process in which generalized solution principles are derived from individual episodes of experience.

A pattern language is a work in progress that continues to develop as long as there are committed team members who record their findings together. As the pattern language develops, the team also develops, because the members explicate their knowledge, work out the core of the findings, and learn for themselves in the process.

It is recommended to write patterns in teams of two or three authors to combine different perspectives and create new knowledge, leading to universally valid solutions. This approach brings together different talents, enriches the dialogue, and ultimately improves the quality of the individual patterns and the pattern language.

2.2.3.2 Additional success criteria for developing a pattern language

To facilitate collaboration, it is advisable to schedule a series of meetings, particularly in distributed and hybrid teams. Collaboration platforms provide efficient options and also enable documentation through meeting minutes. Meeting series that regularly bring together specific team members and focus on particular topics, such as pattern search, pattern creation, and team, administrator, or publication meetings, have proven to be valuable.

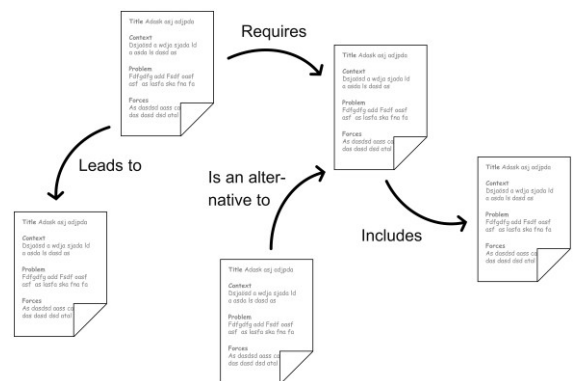


Fig. 6: Patterns connected through various types of relations

2.2.4 Pattern linkage phase

During the pattern linkage phase, individual patterns are interconnected using logical connections to gradually form a pattern language, as shown in Figure 6.

These links are also known as relations. They describe how the patterns are related to each other, what dependencies exist between

them, and how they interact. Table 1 lists some commonly used link types and their definitions.

Tab. 1: Relations for linking patterns

Relation between pattern A and pattern B	Definition or explanation
Supports	A contributes to the quality of B
Belongs to	A is a sub-pattern of B
Requires	A needs B if possible
Leads to	A causes or triggers B
Is an alternative to	A and B have the same context, and the choice between A or B is free
Includes	A contains B

At this stage, a decision must be made regarding the technical representation. Although individual patterns could still be recorded in any Office format or on paper, drawing links between the patterns requires tools with proper features. In principle, such links can also be set as cross-references or hyperlinks (see Fig. 7) in a single large text document containing all the patterns. However, this approach usually results in a lack of clarity. Specialized software for knowledge management or hypertext platforms can now be used to transfer the pattern language into a system that can map the network.

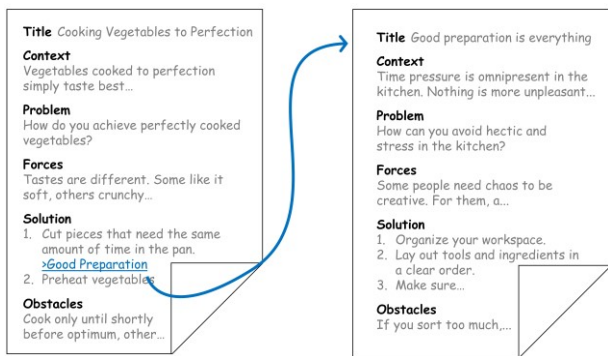


Fig. 7: Two patterns, connected via a hyperlink

The group of amateur cooks prefers a simple method of linking patterns. They do not wish to purchase specialized software and have therefore decided to add an additional section called ‘Linked patterns’ to each pattern. This is where they place cross-references to other patterns, using hyperlinks to allow easy navigation between them.

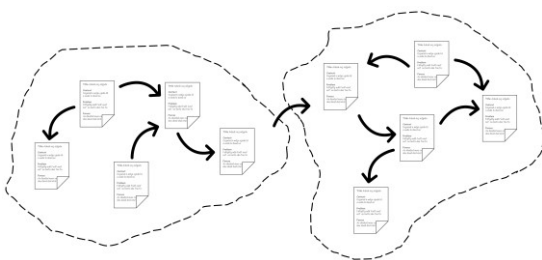


Fig. 8: Growing complexity in the pattern language due to increasing number of patterns and formation of pattern groups

The connected patterns that form a pattern language provide a structured framework for problem-solving. The links enable effective navigation between patterns, facilitating understanding of their relationships and application. The pattern language allows for easy transition from one relevant pattern to another, enabling exploration of different aspects or variants of a solution path. The pattern language becomes more complex and comprehensive by mapping these interconnections (refer to Figure 8). It approaches the structure of experiential knowledge to some extent, as it also contains diverse connections between individual bits of knowledge. Patterns can complement each other, build on each other, or deal with different aspects of larger contexts. In addition, networking can result in the

evolution of pattern groups that have their own context. The structural level is expanded by a content level through content clusters.

During the link definition and assignment process, the pattern language undergoes a content review and refinement. The development team checks all connections to uncover possible inconsistencies and contradictions, which are then resolved by reformulating or reassigning the links. This revision ensures greater consistency in the pattern language. The team may add additions and case distinctions as necessary. This step demonstrates another strength of pattern languages in their ability to grow and evolve over time. By adding new links, the pattern language can become larger and denser (see Figure 9).

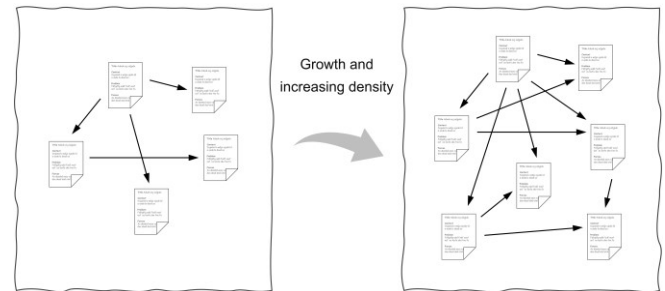


Fig. 9: A growing and evolving pattern language

Once again, the development team is facing challenges. The collaborative approach to dialogue provides richness, diversity, and different perspectives, which are reflected in the numerous patterns and their connections. However, it also results in a high level of complexity in the structure of the pattern language, which is often neither linear, nor procedural, or unambiguous. Presenting this complexity in a clear and manageable way is a demanding task for the team. Understanding it can be a challenge for users when applying the pattern language. The development team may have varying views on what recommendations for pattern selection should be given to potential users. Methodological preferences, industry sectors, and organizational cultures of team members can also affect this. At this stage, it is important to establish a protocol for addressing any inconsistencies that may arise. It is important to note that disagreement does not necessarily equate to failure. One possible solution is to introduce new patterns that incorporate additional structures into the pattern language. These patterns could include selection patterns that outline the key questions to be asked in specific situations to identify the appropriate patterns from a range of variants (refer to Figure 10).

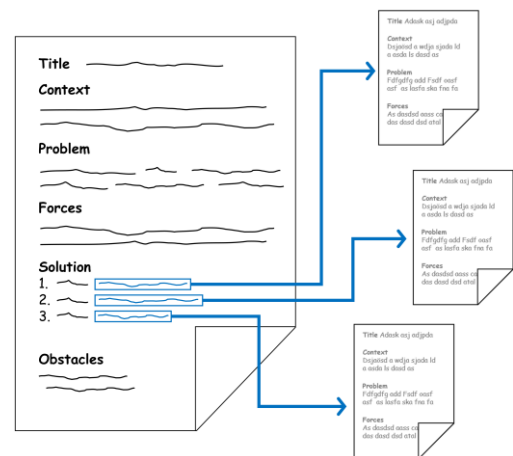


Fig. 10: Branching or selection pattern that facilitates the identification of subsequent patterns, for example, through the use of leading questions.

2.2.5 Usability preparation phase

The pattern language, up to this point, has been primarily understandable and applicable only for the development team. The usability preparation phase aims to allow for other interest groups to apply

the solutions in the pattern language. To achieve this, these interest groups are first defined and described using corresponding personas. This approach helps the development team establish a shared understanding of future interest and target groups. The team imagines potential application scenarios and considers what information could enhance the user-friendliness of the pattern language.

Our cooking professionals define several personas that they believe represent typical user groups:

- Max is a student who wants to eat healthily without spending too much money.
- Iris is a successful manager who has little time for cooking but wants to stay productive.
- Howard is a sprightly pensioner who enjoys cooking for the whole family.
- Mary used to eat a lot of meat with a somewhat guilty conscience and is unsure whether she can be happy on a vegetarian diet.

A profile is created for each persona, describing their life situation, preferences, dislikes, and personal circumstances. These profiles assist the development team in comprehending the information that potential users will require to work with the pattern language.

For instance, appropriate describing keywords are added to the patterns in a new section called ‘Tags’ or ‘Descriptors’. The keywords can then be utilized in search algorithms and topic indices to locate relevant patterns. If needed, attributes can be assigned to the keywords to enhance the accuracy of the search results.

Reflection and revision of the overall structure of the pattern language become possible and necessary when a certain level of complexity is reached, accompanied by a corresponding number of patterns and links. This process presents an opportunity for a significant improvement in quality. It involves intensive revisions of patterns, names, definitions, guiding questions, and links. When developing patterns, there is a risk of unintentionally formulating trivialities and repetitions. In such cases, it is important to concretize and sharpen the connection to the individual pattern. In our pattern language, for example, the issue of insufficient time is a recurring topic in the patterns. Upon closer inspection, we identified the subtle differences in the respective contexts of the patterns. We were able to precisely and specifically formulate this aspect for each individual pattern.

During the usability phase, guides can be trained to provide advice and support to individuals and organizations on the use of the pattern language. Guides act as multipliers by teaching the basics of pattern languages and providing information about the underlying concepts and principles. They use case studies, exercises, or practical examples to teach the target groups how to apply the patterns to real-life problems. Guides can provide personalized consulting services to address stakeholders’ specific questions, concerns, or challenges related to the pattern language. They can also offer valuable feedback to the development team by identifying content weaknesses or design gaps and providing insights for new patterns during practical application. This process helps to identify potential opportunities for further developing the pattern language.

2.2.6 Dissemination phase

There are various ways to make pattern languages accessible to a broader audience. A traditional method of publishing is through text media. These can take the form of reference books, manuals, brochures, or online publications. Providing access to the pattern language through a dedicated website or online platform offers users a more dynamic and modern approach, while also enabling a variety of licensing models. Guided tours, training courses, and workshops emphasize dialogue between the development team and target groups. Such formats can help to communicate the principles and possible applications of the pattern language.

Collaboration with organizations, institutions, or communities from the specialist domain of the developed pattern language can significantly enhance its dissemination. Working together with organizations that have an established network or reach within target groups makes the pattern language accessible to a larger audience. Presenting the pattern language at relevant conferences within the specialist domain offers the opportunity to present it directly to a target audience and engage in dialogue.

Online communities and forums can bring together groups interested in pattern languages and promote collaboration. With the appropriate reach, an online community can offer an effective form of mutual support, as members can help each other and discuss common interests.

Case studies and real-life examples that demonstrate the use and benefits of pattern languages can generate interest and credibility. Examples of successful application of the pattern language in different contexts can inspire others to use it as well.

2.3 Use of digital tools in the development of pattern languages

As previously stated, we utilize various digital tools in our development work. When developing a pattern language, it is important to consider the level of tool support needed. The following criteria can be used to assess this:

- *Size of the development team:* Collaboration tools may be necessary to support the work process and presentation of results when a large number of people are involved in the development of the pattern language.
- *Local distribution of the development team:* If the development team is spread out geographically, it may be necessary to use tools for online communication and virtual collaboration.
- *Scope of the pattern language:* As more patterns are added to the pattern language, it becomes increasingly important to have tools for structuring in order to maintain a clear overview.
- *Degree of interconnectedness of the pattern language:* As more relationships are added between the patterns, additional tools are required to visualize them.
- *Development progress of the pattern language:* As development progresses, more specialized tools will be utilized, up to the point of a comprehensive knowledge management system, where, for example, keywords can be added and search algorithms can help find appropriate patterns.

In our development work, we adapt tool usage to accommodate the growing team and development progress of the pattern language. Initially, tools with a focus on communication and artifacts are particularly important for the small development team (refer to Figure 11). For digital collaboration, an online meeting tool from the Communicate category is adequate, while for content production, a word processing system from the Publish category is sufficient. Text files can be exchanged via email. Occasionally, tools from the Visualize category are needed to make structures and connections visible (for categories, see Mittelmann 2019, 17–19).

As the development team grows, collaboration tools are incorporated. The documents produced are stored in an online document management system that is accessible to all team members. It is crucial in this tool setting that everyone is aware of the current status of the documents and always works with the latest versions.

The need for a tool that supports creating and visualizing connections between patterns increases as the network of patterns in the form of structural and content-related links becomes stronger. To meet these requirements, an integrated tool that provides functions for collaboration, networking, sharing, visualization, and search is necessary. Using such a tool can significantly improve the quality of development work.

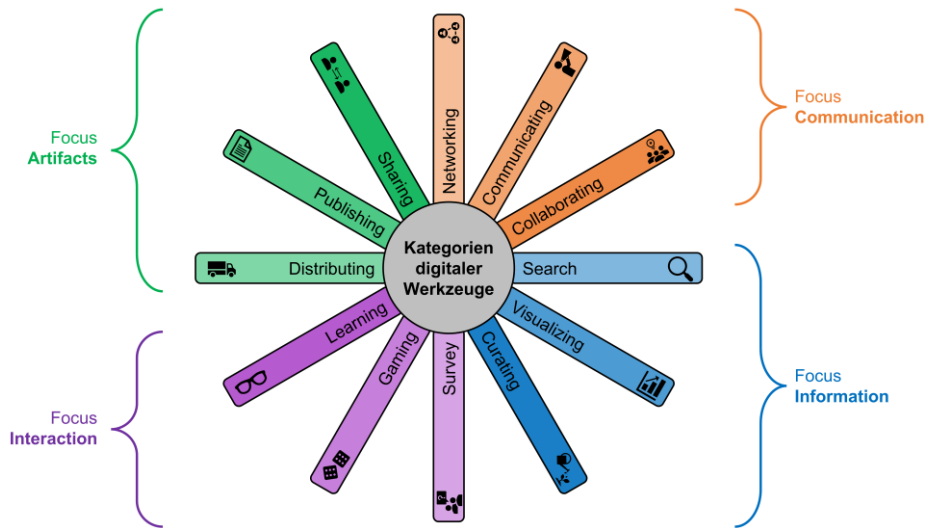


Fig. 11: Categories for digital tools in knowledge management (Mittelmann 2019)

In summary, our development process has undergone digitalization, progressing from level 0 (using a spreadsheet and word processing system) to levels 1 and 2 (utilizing online meeting, collaboration, whiteboard, and mind mapping tools) and finally to level 3 (implementing a knowledge management system) (see Fig. 12).

Our recommendation is that each development team observes its work process and decides which digital tools could provide the best support in the subsequent steps. It may be necessary to bring additional IT expertise into the team.

3 Application of a pattern language

Although success stories and studies have been published on the use of pattern languages, applying them can be challenging for those not involved in development. The process of moving from a use case to a suitable collection of patterns with the necessary solutions presents several obstacles. However, with each application, the process becomes easier.

To overcome these obstacles, a first-time user of the pattern language should seek assistance from a member of the development team or an experienced user. These individuals serve as guides for navigating the pattern language and assist in identifying appropriate paths, of which there are typically multiple options. Another way is to utilize the search function in the digitized pattern language to locate suitable solutions.

For both cases, the initial step is to describe the use case and the specific problem in a clear and comprehensive manner. A guide can assist by requesting a detailed explanation of the situation with clear examples. If the conditions described are vague, the guide will ask more detailed questions to create a more accurate picture of the task. Whenever possible, participants should formulate these tasks together in the form of one or more questions.

Upon revisiting our cooking experts, their pattern language, which is full of experience in good cooking, is put to the test when one of their children or grandchildren asks, 'How do you make this delicious Reindling (a special cake that is native to Carinthia in Austria)? What are all the ingredients?' The expert will then inquire in more detail about the occasion for which the child would like to make the Reindling, which ingredients are already available, and which important ones are missing. In this way, they check the feasibility of producing the pastry together.

The challenge ahead is to match the case description with the patterns of the pattern language. It is recommended to start with the more general patterns and use the relationships between them and more detailed patterns to delve into the deeper layers. If the pattern language includes short descriptions for each pattern, consisting of context, problem, and summary of the solution, it is advisable to begin by getting an overview using these abstracts or just the pattern titles. Users can select patterns with confidence once they determine that the provided titles and brief descriptions accurately outline possible applications and solutions. Alternatively, users can initially select a larger number of potentially applicable patterns and then categorize them into groups such as 'definitely use', 'use if necessary', and 'consider as framework information'. The collection of these patterns contains reliable empirical knowledge for solving the use case.

This is an example of how the use of a pattern language may appear to an individual. As described in Section 2.2.6, the goal of any development team creating a pattern language is to promote its use among the widest possible audience of relevant specialists. Once some guides have gained experience, it is possible to establish a user community for the pattern language around these experts. The community should appoint an experienced guide for community management. The guide will oversee the growth of the community and the development of the pattern language. Regular contributions to

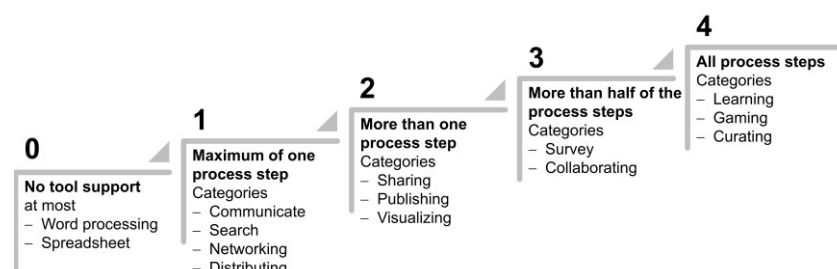


Fig. 12: Digitization stages (Mittelmann 2019)

associated pattern language forums will support community growth. The guide will communicate regularly with the development group to facilitate further development. Community management may also be performed on a rotating basis by a group of guides.

4 Summary

Experiential knowledge of groups can be expressed and shared through pattern languages. Each pattern language refers to a specific domain. The concepts and solutions presented in this domain have been proven to be successful. The recipes in the patterns are concisely formulated and follow a standardized structure that includes the problem solution, specific context, and possible obstacles to implementation. The pattern language links related topics, creating a cohesive knowledge network that allows learners to explore the domain and find solutions to their challenges.

To express their expertise in a specific domain using a pattern language, a group should first form a development team. The team should be prepared to engage in open, appreciative dialogue and identify successful concepts, tried-and-tested principles, and ways to express their knowledge. This process helps the team members build a dialog-oriented community of values that deals constructively with different perspectives. Through dialogue, individuals create a shared understanding of their experiences and uncover a collective wealth of knowledge. The resulting patterns are interrelated, analyzed, and recorded in depth, leading to a more consistent and sophisticated pattern language. Thus, the pattern language becomes easier to understand and clearer, ultimately making it accessible to a wider audience.

At the end of the process, a pattern language is created that contains the wealth of knowledge from the experienced group. Unlike theory-based collections of knowledge, a pattern language specializes in

mapping tried-and-tested knowledge and procedures in a way that allows for quick and easy use. Applying the pattern language encourages newcomers to the specialist area to access the development team's experience in greater depth than other forms of knowledge transfer. The pattern language provides access to experience that would typically take decades of professional practice to acquire. Groups that aim to pass on their experience to future generations should consider embarking on the challenging but rewarding path of pattern language development because it allows them to preserve and share an incredible wealth of knowledge in this way.

References

- Alexander, Christopher; Ishikawa, Sara; Silverstein, Murray (1977). *A Pattern Language. Towns, Buildings, Construction*. Oxford University Press.
- Bauer, Reinhard (2014): *Didaktische Entwurfsmuster. Diskursanalytische Annäherung an den Muster-Ansatz von Christopher Alexander und Implikationen für die Unterrichtsgestaltung*. Thesis. Faculty of Interdisciplinary Research and Further Education, University of Klagenfurt.
- Grundschober, Isabell (2018). *Eine Mustersammlung für Feedback. Feedback-orientiertes Lernen und Lehren mit dem ePortfolio in der Hochschule durch Handlungsmuster fördern*. Master Thesis. Applied Knowledge Management, University of Applied Sciences Burgenland.
- Gamma, Erich; Helm, Richard; Johnson, Ralph; Vlissides John (1994). *Design Patterns. Elements of Reusable Object-Oriented Software*. Addison-Wesley.
- Iba, Takashi; Kaneko, Tomoki; Kamada, Arisa; Tamaki, Nao; Okada, Makoto (2016). Words for a Journey: A Pattern Language for Living Well with Dementia. In Baumgartner, Peter; Gruber-Muecke, Tina; Sickinger, Richard (Eds.): *Pursuit of Pattern Languages for Societal Change*. Designing Lively Scenarios in Various Fields. <https://www.purplsoc.org> (accessed on 2023-11-22).
- InterQuality Architekten GmbH & Konglomerat e.V. (2018). *Die lebendige Stadt. Eine Mustersprache für gute Zusammenarbeit*. <https://stadtraum.jetzt/mustersprache> (accessed on 2023-11-22).
- Mittelmann, Angelika (2019): *Wissensmanagement wird digital*. Book on Demand.

The Frankfurt Knowledge Group is a team of five friends with extensive experience in practical knowledge management and in supporting knowledge transfer processes. They came together due to their fascination with the concept of pattern languages, which led them to develop a pattern language for knowledge transfer. The group met in Frankfurt, which inspired the name FKG – The Frankfurt Knowledge Group.



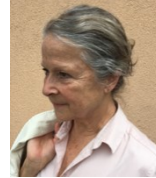
Angelika Mittelmann: Computer scientist with decades of experience in knowledge management, in facilitating knowledge transfer and change processes in the industry, in teaching (university), consulting, and training; Knowledge Management Award 2015; Member of the GfWM Advisory Board (Knowledge Management Society in Germany, Austria, and Switzerland) since 2016.



Christine Erlach: Master of Psychology, founder of the consulting firm NARRATA Consult, using narrative methods in organizations since the 1990s to uncover hidden knowledge treasures, values, and attitudes and to make them usable. She is coach and author of numerous publications on narrative knowledge and change management.



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Grit Terhoeven: Master of Psychology, introduced the transfer method 'Transferwerk' at Salzgitter AG. Facilitating numerous transfer processes in different organizations, complemented with a focus on coaching in the transfer process.



Manfred della Schiava: Knowledge management pioneer of the first hour who helped to shape the development of this management movement. He is the founder of the 'Wissensberater-Netzwerk' (Knowledge Consultant Network) and developed the 'Wissensberatung-Methode' (Knowledge Consulting Method). His heartfelt concern is well-being of all mankind so that exchanging knowledge can be pursued with joie de vivre.