TOWARDS A PATTERN LANGUAGE APPROACH TO ESTABLISHING PERSONAL AUTHORING ENVIRONMENTS IN E-LEARNING

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ABSTRACT
Establishing a suitable environment for multimedia course production is important for e-learning authors. Such an environment includes two primary components: an authoring station for preparing the artifacts and a physical workplace where authoring takes place. The establishment of the environment is a non-trivial task because it involves several disciplines such as IT, pedagogy, and human-computer interaction. Inspired by Christopher Alexander's work on pattern languages, this paper proposes a pattern language for establishing personal authoring environments in e-learning. The pattern language takes the end-user perspective and can be applied by people with interests in creating a personal authoring environment for producing quality e-learning contents. Its use is illustrated with an example.

KEY WORDS

1. Introduction
For most creative and thought-intensive activities, working environments can have a significant impact on author's productivity. For example, software development community has reported that facility strategies, including office layout, furniture, and development tools, all have a great impact on software construction [1, 2, 3]. In the context of e-learning, multimedia course authoring is also a creative, thought- and technology-intensive activity. However, little has been reported on the issues of establishing suitable authoring environments.

In this work, the problem of establishing suitable authoring environments is examined in the context of personal authoring [4]. Specifically, personal authoring refers to the practice in which the author is solely responsible for the development work, such as the preparation of course components and the synthesis of final presentation [4]. Personal authoring is further characterized with authors completing the development work on commodity-grade PC equipment. Personal authoring is applicable in small and medium enterprises as well as educational organizations, especially when there is little resource available for building a professional grade authoring studio to produce e-learning contents.

An e-learning personal authoring environment includes two primary components, namely, the authoring station for producing the artifacts and the physical workspace where authoring takes place. The two components are closely related. Indeed, many presentation inconsistencies can be seen as the consequences of inappropriate interactions between the two components. For instance, in a course where the instructor's presence is realized through video, the produced video clips can be inconsistent due to changes in backdrops, dresses, voice volumes, and shooting positions. These changes are usually too subtle for the author to detect during personal authoring. Nevertheless, their effects are easily felt by learners when the video is viewed. Most often, this is caused by inappropriately placing the authoring station inside the physical workspace.

Typical ways of avoiding the inconsistencies include shooting against a subdued backdrop; arranging to have the instructor take a comfortable posture that remains relatively fixed; marking the camera and chair positions so that shots remain fixed; having the instructor talk in a consistent tone and volume in delivering the lecture; and so on. As can be seen, establishing such an environment involves issues related to IT, tool, pedagogy, and human-computer interaction (HCI). To some extent, these issues have been individually addressed. For example, the technology and tool issues have been discussed in [5]; issues on pedagogy or instructional design can be found in [6, 7]. Even so, weaving these issues into an applicable solution can still be a difficult and complicated task.

This paper takes the pattern language approach to address the issues of these different aspects in establishing authoring environments. The pattern language encompasses previously known architectural and e-learning patterns [8, 4] as well as a number of patterns related to e-learning authoring workplaces, which are the
main theme of the present paper. Two principal sub-languages regarding authoring stations, authoring workplaces, and their relationship are identified. In particular, since the pattern language is empirical in nature and takes the end-user perspective, the patterns and the languages are reusable by anyone interested in building a personal authoring environment, in much the same way that Alexander's pattern language is used by “laymen” for designing gardens and buildings [9].

The rest of this paper is organized as follows. In Section 2, the pattern approach and its adaptations by some other disciplines are briefly reviewed. In Section 3, the pattern language for building a personal authoring environment is presented. Section 4 gives a conclusion and indicates possible future research directions.

2. Background

The concept of patterns and pattern languages originated from the field of architecture by Christopher Alexander in the 1970s [9, 10]. Based on the theory, Alexander and his colleagues published 253 architectural patterns [8], and documented their experiments and practices based on pattern languages [11, 12, 13]. The pattern languages cover a wide spectrum from urban design to building and garden design. Each pattern solves a recurring problem in a context, and a pattern language is a collection of closely related patterns. Patterns inside a language are selected through a rigorous process; they are reinforced by each other. Alexander takes the end-user perspective by insisting that the pattern languages be usable by people to design for themselves. By speaking the same pattern languages, people achieve the quality without a name [9] in the buildings and towns they created.

The following briefly describes the process for constructing a pattern language. First, a collection of patterns relevant to the problem context is captured. From this collection, a number of candidate patterns are selected and the relationships among them are made explicit. In so doing, the patterns are examined one at a time, starting from the large-grained defining patterns that characterize problem as a whole, and ending with fine-grained supporting patterns for realizing a solution to the problem. After elaborating on the pattern, other patterns that must come under the pattern in order to make it complete are identified. The process is iterated until a clear picture of solution emerges.

The pattern language approach has been adapted by many communities outside architecture. The software community is one in which many success stories can be told. Both in academia and industry, people have successfully applied patterns to software design, analysis, architecture, testing, and refactoring [14, 15, 16, 17]. Another noticeable adaptation is the HCI community that has applied patterns to user interface and usability designs [18, 19]. Patterns have also been found useful for introducing change in organization [20]. In the e-learning community, patterns have been used in instructional design, pedagogical design, and learning technology system design [21, 22, 23]. Recently, a European Union funded project has adopted the pattern language approach to building a knowledge base for educational design [24].

3. The Proposed Pattern Language

Alexander's process is applied for constructing the proposed pattern language [9]. Any collection of patterns that solve recurring problems takes time to develop. In the present case, the patterns are discovered from the authors’ past experiences in developing and deploying industrial and academic e-learning systems and applications. The collection of patterns is shown in Table 1. A pattern example is shown in Fig. 1.

<table>
<thead>
<tr>
<th>Category</th>
<th>Patterns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content Production Concepts</td>
<td>Separation of Material Preparation and Integration, Type-Specific Media Production, Material Integration</td>
</tr>
<tr>
<td>Configuration of Computer</td>
<td>Personal Authoring Station, High-End PC for Multimedia Authoring, Amateur Studio</td>
</tr>
<tr>
<td>Content Consistency</td>
<td>Coherent Authoring</td>
</tr>
<tr>
<td>Material Production</td>
<td>Screen Capture, Slide Editing and Presentation, Mono Directional Microphone, 16-Bit Sound Recording, Live Recording, PC Camera, Digital Camera, Audio/Video Capture, Scanner, HTML Editing, Image Processing, Post-Production, Non-Linear Audio/Video Editing</td>
</tr>
<tr>
<td>Working Environments</td>
<td>Distraction-Free Workplace, Workplace for Sustaining Concentration with Intermission, Attitude Transition, Walk-Around Area, Good View, Quiet Corner, Sufficient Lighting, Subdued Backdrop, Large Table, Comfortable Seat, Favorite Drink, Equipment in Fixed Position, 1024x768 Screen Resolution or Better</td>
</tr>
</tbody>
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Workplace for Sustaining Concentration with Intermission

**Context:** Authoring activities require concentration. A distraction-free workplace helps you concentrate. However, you easily get tired and sleepy while concentrating on the authoring activities in such an environment.

**Problem:** What kind of workplace do authors need?

**Forces:**
- Authoring demands that you stay fully focused.
- Too much concentration for a period of time may result in narrowed and reduced awareness.
- Creativity and productivity gradually decrease after working for a period of time.
- Taking too many long breaks results in poor productivity.

**Solution:** Establish your workplace so that it is closed for distraction and open for relaxing and thinking. For example, your workplace is configured as *Alcoves* [8]. You get less interference in such a workplace but are in easy reach of company if needed. Authoring is a thought-intensive activity that demands your focus. Keeping your mind clear is just as important as keeping interruption and interference away from you. By working in an environment that allows concentration to be balanced with appropriately placed intermissions, authors are not only more creative and productive, but also more joyful about the authoring.

**Resulting Context:** Sometimes this pattern is realized in isolated workplaces that are remote from the regular activities, e.g., an isolated meeting room. Although there is little interference, staying in the room can make you feel lonely; you can lose focus due to authoring alone after a period of time. You should find ways to balance the forces, e.g., use *Attitude Transition* to refresh your thoughts.

**Figure 1. A pattern example**

A personal authoring environment pattern language must address two essential issues: the preparation of an authoring station (a computer) with properly installed software and hardware and the preparation of a distraction-free place for producing contents. The former involves information technology; the latter is related to physical space design.

### 3.1 Personal Authoring Station

A Pattern language for preparing personal authoring station has been presented [4]. In this section, an example is used to illustrate the use of the pattern language. Consider the following scenario. You are a senior software architect working in a company that develops accounting applications. You have found that many of your project development experiences are helpful in getting the new developers ready when they join a project for the first time. You decide to produce a series of e-learning courses that reflect your experiences to serve this purpose. Most of all, since you have a busy schedule, going to a professional grade studio to produce the courses is out of the question. You thus decide that personal authoring is a viable alternative.

To do so, digital contents are produced and then organized into courses. *Separation of Material Preparation and Integration* guides the organization of the work and manages perspectives since it is necessary to rapidly switch between these two activities.

To create course contents, a multimedia authoring station is needed. By applying *Personal Authoring Station*, you configure your laptop into an authoring station with a little investment on the required peripherals and software. The laptop is chosen since the courses will be created both in office and at home.

Next, the presentation style has to be decided. Since many PowerPoint files have been prepared from previous training classes which you delivered in person, they will be reused with minor modifications. Therefore, *Type-Specific Media Production*, which is realized through *Screen Capture* and *Slide Editing and Presentation*, seems good for this purpose.

Also, since you will not deliver the courses in person, an audio/video stream serves as a good enhancement to the slide presentation. This calls for *Live Recording*, which includes *PC Camera* for video capture and *Mono Directional Microphone* for audio input. Note that *PC Camera* is a lightweight device, which is very convenient for a mobile user. *Mono Directional Microphone* is used to ensure that audio is captured with background noise suppressed. The *16-BIT Sound Recording* ensures that soundtracks are recorded with good quality.

In the next step, it is necessary to assemble these individual components into an integrated course. *Material Integration* suggests an incremental process for
integration. Finally, since it may not be feasible to complete the production of a presentation unit in one sitting, Coherent Authoring is used as a reminder for the consistency of presentation, including the voice volume, the video position, the lecturer's dress, and the style of slides. Fig. 2 is the constructed pattern language based on the above scenario.

A Large Table is put in the room to provide sufficient working surface for authoring equipment and artifacts, such as Personal Authoring Station, documents, and a cup of coffee (Favorite Drink). When practicing creative activities such as authoring, the drink not only replenishes the physical need but also plays a role of fostering thoughts and changing moods (Attitude Transition). Both the drink itself and the actions of drinking contribute to the effect.

Since authors will probably spend most of the authoring time sitting in a chair, a Comfortable Seat is vital. This pattern prevents authors from getting tired. Note that the seat must be compatible with the Large Table. The resulting pattern language is given in Fig. 4.

3.2 Physical Workplace

You need to find a right place to carry out the authoring activities illustrated above. This chosen place must balance two major forces. One is to support the content production activity, such as providing adequate lighting for video recording; the other is to provide a distraction-free environment for work. Fig. 3 is your office layout. First of all, a place that supports Workplace for Sustaining Concentration with Intermission has to be identified. This pattern is primarily characterized by Quiet Corner and Attitude Transition. At the first glance the conference room seems to be a perfect place for the purpose. It is a private workplace and is quiet enough when the door is closed. The conference room also satisfies Windows Overlooking Life [8] and is large enough to offer a Walk-Around Area. Both of the two patterns help in an author's attitude transition and in renewing his/her concentration (Attitude Transition). However, except during weekends and late evening hours, it is usually not possible to reserve the whole conference room for personal use. An alternative has to be chosen. Thus, the sleeping room, which is originally designed for relaxing and sleeping but is under-utilized somehow, becomes the candidate. A short video clip is recorded in the sleeping room to assure that the lighting is adequate for video recording (Sufficient Lighting). The sleeping room also provides Windows Overlooking Life but is too small to offer a Walk-Around Area. Fortunately, a nearby Walk-Around Area is available just outside the room.

Figure 2. The personal authoring station pattern language

Figure 3. The office layout

Figure 4. The physical workplace pattern language
3.3 A Complete Environment

With the laptop properly equipped for personal authoring and the workplace selected, the relationships among patterns are explored and evaluated so that the two pattern languages combine seamlessly into wholesome one. First of all, since it is necessary to have a large enough working surface for authoring, the laptop (Personal Authoring Station) is put on the Large Table. For video recording with PC Camera, Sufficient Lighting and a Subdued Backdrop are required. Finally, Sufficient Lighting and Subdued Backdrop are connected to Coherent Authoring so that presentation consistency will be maintained. Fig. 5 shows the complete pattern language for establishing personal authoring environments. Newly found relations that connect the two languages are illustrated in dashed arrows. Fig. 6 presents the picture of the constructed environment and Fig. 7 is a course screenshot produced in the established environment.

When the two pattern languages are synthesized into one, new patterns and relationships may emerge. In this case a new pattern Subdued Backdrop is added into the language. It provides an inconspicuous background so that the captured talking head stands out properly. The need for Subdued Backdrop is not obvious until the authoring station is placed into the physical workplace and after considering video recording requirements.
4. Conclusion and Future Work

A pattern language for establishing personal authoring environments in e-learning has been proposed. Elements inside the language reflect the authors’ experiences in developing e-learning systems and applications both in industrial and academic settings, including companies in Hi-tech, insurance, and banking sectors. In its implicit form, the pattern language has helped in creating hundreds of on-line courses for organization training. In one example, a Hi-tech manufacturer was able to produce dozens of courses in a very short period of time and with a low production budget. These on-line courses proved instrumental in training a large number of new employees in two offshore sites.

Although only personal authoring environment is considered in the present work, Alexander's approach should be applicable in more general e-learning contexts as well, including instructional design and learning design. In particular, once languages are formed, they will then be possible to consider issues of a broader nature, for example, how instruction design is related to personal authoring environments.

References