

# Exploring User Requirements through Mind Mapping

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## Abstract

*Documenting user requirements – writing Use Cases or writing User Stories in an Agile context – is always a challenging phase in software development. There are no standard processes or notations defined, and the only understanding is that the primary factors that make this activity effective are communication and facilitation skills. In this paper, I propose using mind mapping that focuses on those primary factors to explore “User Wish” – a vague shape of user requirements before it is written into a form of requirements. Then I take this concept one step further and model convert resulting mind maps into UML.*

## 1 What is Mind Mapping?

Mind mapping is a graphical technique of taking notes and visualizing thoughts using a radiant structure [Buzan03].

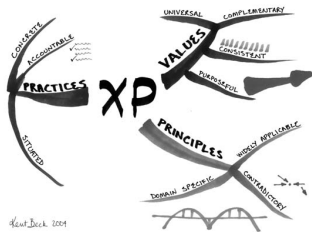


Figure 1 XP Mind Map [Beck05]

Around a central image, radial branches called BOIs (Basic Ordering Ideas) grow with keywords along them, and associative sub-branches grow recursively. In Figure 1, “XP” is the central image and “Values”, “Principles” and “Practices” are the BOIs.

A Mind map is logically a simple tree structure of keywords, but has a radiant shape with colors, pictures, and drawings. The human brain is much better at recognizing shapes or patterns than words or numbers. Let me give you an example. Imagine that you meet an old high-school friend accidentally in a crowd and you recognize her in a second. Your brain stores pictorial information much more efficiently than hard-disks do, and can search the database for a specific image faster than computers do.

Roger Sperry<sup>1</sup> found that the cerebral cortex has two hemispheres, and the cortex tends to divide the major intellectual functions between them. The research showed that the right side appeared dominant in rhythm, spatial awareness, gestalt (wholeness), imagination, dreaming, color and dimension, whereas the left side appeared dominant in words, logic, numbers, sequence, linearity, analysis and lists.

By stimulating the right brain (shapes, colors) as well as the left (logical keywords), mind mapping has a greater power to evoke human memories than ordinary linear notes do.

<sup>1</sup> A Nobel Prize winner in physiology, 1981

Some of the properties of mind maps that make them so effective include:

- Keyword Orientation: The structural elements of mind maps are not sentences but keywords.
- Loose Syntax and Semantics: Association is the only relationship between linked keywords.
- Fast and Easy-to-use: You can use mind maps as real-time shorthand minutes for meetings, interviews, and other conversational sessions.
- High-Level View: You can overview a whole mind map in a glance.
- Evocative: A mind map evokes the context of the scene in which it was created.
- Semi-structured<sup>2</sup>: A mind map can have a template structure but it can grow branches on demand to capture real-time verbal communication in semi-structured interview.

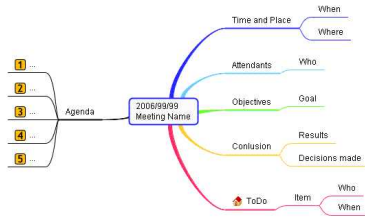
## 2 How Software Development Benefits from Mind Mapping

Chuck Frey's survey [Frey09] shows that the top three business applications of mind maps are "To do list," "Preparing presentations," and "Note taking." The followings are examples of situations and phases in which you can utilize mind mapping effectively in your software development activities and the following are my experiences.

- Meeting Minutes and Agenda: Add a visual effect to your agenda items by mapping them out. During the meeting, connect your laptop to the overhead projector and take notes on the conversation in real time. I call this a "meeting log" mind map. The preset mind map has open BOIs for “Conclusion” and “ToDo” items, so that the facilitator can address the final settlement rather than leave the conclusion and action vague

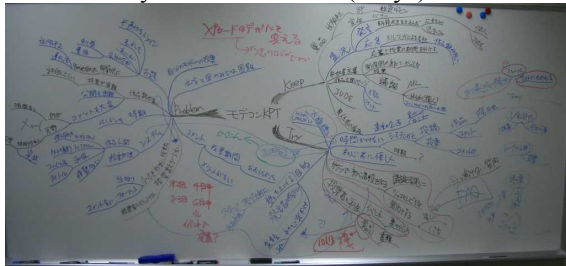
<sup>2</sup> Semi-structured data is a tree-structured data that doesn't have predefined schema. Semi-structured interview is a type of interview in which the questions are not predefined completely.

and undecided. Here's an example of a minute template.



**Figure 2 Meeting Agenda Template**

- Brainstorming – A team can brainstorm using mind maps. Here's an example picture of a mind map brainstorming, using Alistair Cockburn's Keep/Problem/Try reflection format [Cockburn01](Figure 3). A team uses this format to reflect on a past event and improve for the next time. It has three preset BOI's named "Keep", "Problem" and "Try." In the team reflection, members of the team talk about the things you should keep doing ("Keep"), problems you find in the last event ("Problem"), and the things you want to try in the next event ("Try").



**Figure 3 Team Reflection by Mind Map (Alistair's Keep/Problem/Try format)**

Other than my experiences, Suzanne Robertson [Robertson99] briefly discussed the idea of using mind maps in the requirements process. In the agile context, Craig Larman [Larman03] introduced mind maps as one of agile practice tips for rapid approach to requirements.

### 3 User Stories and Mind Mapping

One of the core values of Agile is "interaction." The key mind shift is from "writing (documentation)" to "talking (conversation)."[Cohn05] In XP, "Story Cards" are the record of conversations in a user interview session. By restricting written information to a tangible and small card, it naturally promote conversation with the customer. Story cards are often written by the customer by hand and posted on the walls of the development workspace so you can evoke the memory of the conversation by looking at the card. It means that the story card works as a memento of the conversation. At the same time, if you have a question about the story, you can remove the card from the wall and discuss it with the customer with the card. So it is also called "a ticket to conversation."

Mind maps also have strong memory evocativeness, capturing the context of the conversation. The shape, color and other properties help the participants of the conversation remember the situation. In that sense, a mind map can be a context-embedded memo, just like hand-written story cards.

## 4 Exploring "User Wishes" Through Mind Mapping

A user story is a fragment of a user wish. I suggest utilizing a user-wish mind map to capture user wishes as a whole. I call this mind map a "User Wish Mind Map." Remember that a mind map is as evocative as story cards, yet it is a better tool for seeing the whole story on a high level. Also, a mind map is a flexible data container that supports semi-structured interview. An interviewer may use predefined templates to start with, but can also add a new branch impromptu to focus on subjects the interviewee really want to talk about when the conversation goes toward unexpected directions.



**Figure 4 User Wish Mind Map template**

Figure 4 is a template mind map prepared for a user conversation to capture user wishes. I prepare BOI's in advance as questions to ask the users.

1. *Who will be happy because of this system and why?* I always ask this question first to capture the system's stakeholders and their values, current problems, context, and expectations. These are the essential success factors and risk drivers behind requirements.
2. *Who will use the system?* This question captures system users and potential use case actors.
3. *When will they use the system?* This captures the system's story or use case candidates.
4. *What information do you want to manage with the system?* This question can gather entities or objects of the domain model, including user concerns and domain keywords.

I used this format to capture a city library system. During the interview with a librarian, I asked questions and concurrently noted a mind map.

Note the items in the Homework BOI--an action to follow up on a session question and the schedule of the next meeting. Mind maps have a flexible format that accommodates these accidental topics, which shows a benefit of semi-structured data handling capability of mind maps. Appendix A 10is the result of my one-hour interview session with a real librarian.

## 5 Converting Mind Map to UML

After exploring the whole picture of what the user wants, there are two ways to proceed. One is to gather user stories, as in XP planning games. The other is to create an agile model of use case models and domain entity models. For either process, the user-wish mind map is a good starting point. In this paper, I'll show the latter path.

On the user wish mind map, I add icons of actors, use cases and classes to their candidates. The prepared BOI questions are designed to capture them. In Appendix A you can find a UML use case diagram and a class diagram generated from the mind map.

Using mind maps in conjunction with UML means dividing requirements exploring thinking into two modes. The first mode is “Requirements Gathering (User Wish Exploration)” with mind maps. It captures and shares vague ideas and keywords at high level view quickly. The second mode is “Requirements Modeling” with UML. In this mode, you model domain objects and use cases from the keywords gathered in the first mode. I found that “gathering mode” is a divergent thinking, whereas “modeling mode” is a convergent thinking.

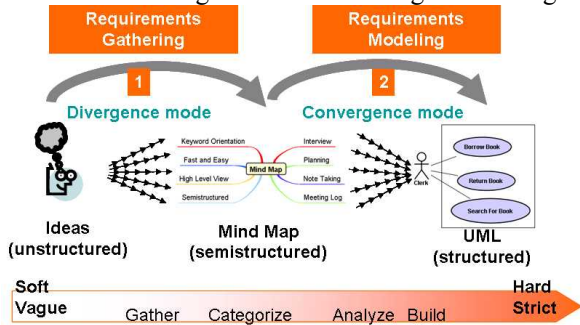


Figure 5 Requirements by Mind Map and UML

## 6 astah – Mind Map and UML editor

We have been developing a complete UML editor called “astah<sup>3</sup>” since 1997. Recently we combined a new Mind Map feature with the tool so you can generate UML diagrams via Mind Maps.

All the diagrams in the Appendix A are drawn by the tool.

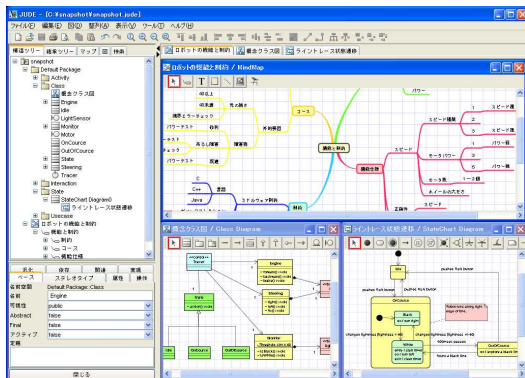


Figure 6 astah\* – UML and Mind Map integrated tool

In astah, each topic (node) of Mind Maps can be dragged and dropped in any UML diagrams. According to the UML diagram into which the topics are dropped, astah converts the Mind Map topics into UML model elements such as classes, use cases, actors, states, activities, and so on.

In the city library example, after filling the answers to the prepared questions, you get good candidates of actors, use cases, and classes. In Figure 7, “Borrow Book” in the Mind Map tree is dragged and dropped into a use case diagram. It is automatically converted to a use case.

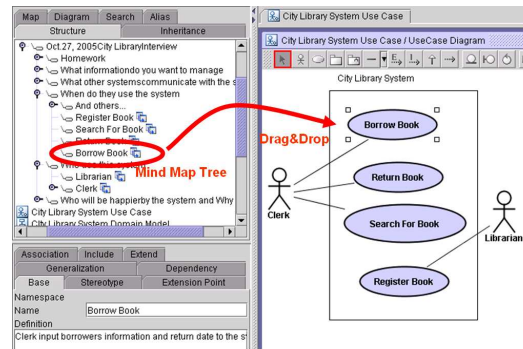


Figure 7 Drag Mind Map and Drop into UML

## 7 Conclusion

I first summarized the benefits of Mind mapping in software development, and introduced a new method of exploring user requirements by “User Wish Mind Map.” Mind mapping offer the interviewer a semi-structured format of inquiry that supports asking important questions as well as accommodating unexpected topics. It also helps eliminate communication errors and captures a soft structure of user wishes at a high-level view. In addition, mind maps help users recall the scene of the session in which the information was recorded.

After gathering ideas in a mind map, you can use the keywords as seeds of UML model elements. By the rigorous syntax of UML, you can build a rich semantics of domain model and use them as a design of the application program.

Agile software development discovered that one of the key success factors of software development projects is communication among involved people. There are many ways for transporting and sharing information but neither formal documents nor casual conversations are adequate. Nothing is quite as effective as just the right set of concise diagrams and graphs that capture the essence of the situation. In this context, mind maps and UML diagrams work quite well in each suitable area for capturing vague and unstructured user wishes, making them semi-structured then structured to transport them through software development lifecycle.

“User Wish Mind Map” utilizes the mind map’s properties; keyword-orientation, evocativeness, high level view, and semi-structuredness.

## 8 Acknowledgements

Mary Poppendieck reviewed this article thoroughly and gave me a lot of advice and suggestions. Kent Beck also looked at the tool in JavaOne Sun Francisco 2006 and gave me thoughtful comments.

## 9 References

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- [Beck05] Kent Beck, “Extreme Programming Explained 2<sup>nd</sup>”, 2005 Addison-Wesley
- [Larman03] Craig Larman, “Agile and Iterative Development”, 2003 Prentice Hall
- [Cockburn01] Alistair Cockburn, “Agile Software Development”, 2001 Addison-Wesley
- [Cohn04] Mike Cohn, “User Stories Applied”, 2004 Addison-Wesley
- [Robertson99] Suzanne Robertson, James Robertson, “Mastering the Requirements Process”, 1999 Addison-Wesley

<sup>3</sup> You can download evaluation copies of the tool from <http://astah.change-vision.com/> astah\* is the UML tool formerly known as “JUDE.”

[Frey09] Chuck Frey, “Results of Mind Mapping Software Survey”, 2007 <http://mindmappingsoftwareblog.com/results-of-mind-mapping-software-survey-now-available/>

# 10 Appendix A(Mind Map and UML of City Library System)

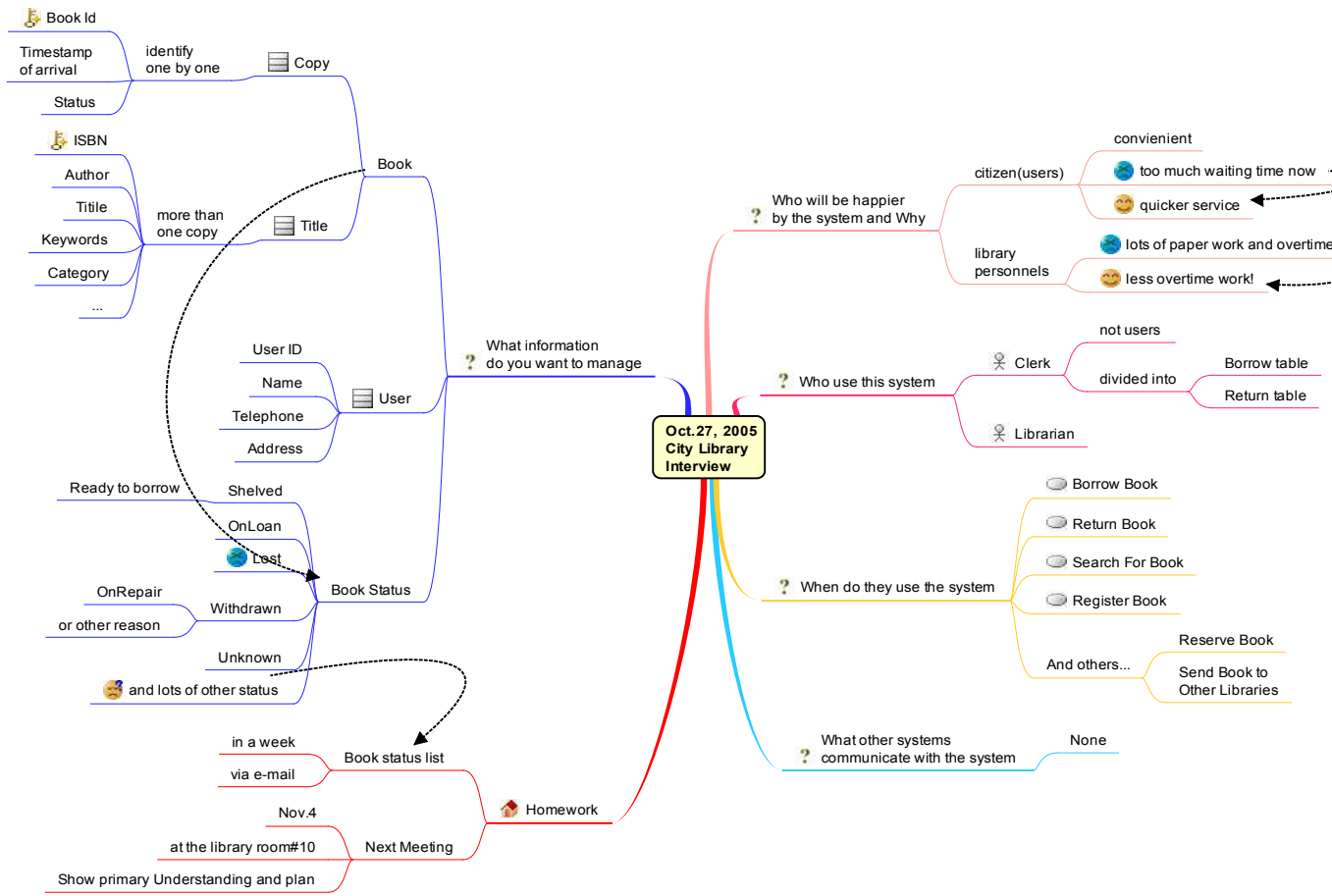


Figure 8 Mind Map of User Interaction (User Wish Mind Map)

Use Case Diagram

Class Diagram

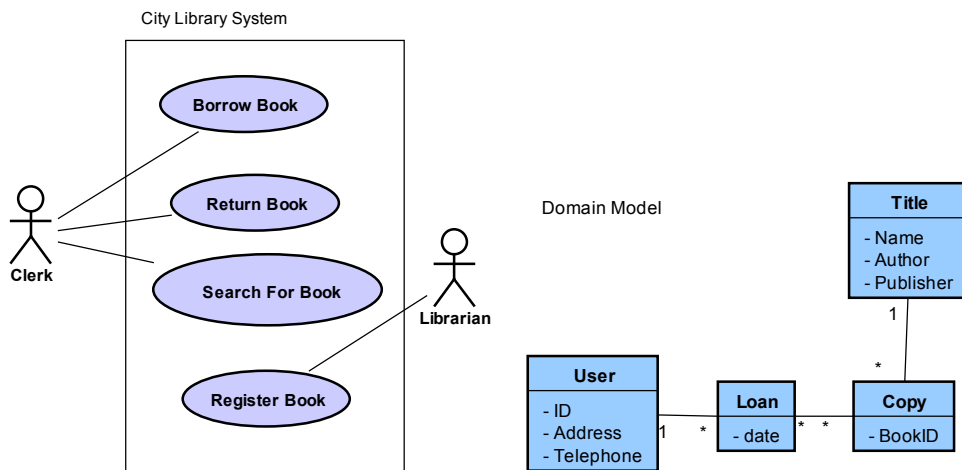


Figure 9 Use case and Domain model