Theory and Practice
A Discipline-independent Pattern Approach for Capturing and Communicating Problem Solutions
Background

Center for Human-Computer-Interaction, University of Salzburg, Austria

Background:
General Philosophy of Science and Science of Consciousness
Interdisciplinary Workgroup Neurosignaling, Department of Zoology, University of Salzburg
Since 2012: Center for HCI

Main topics:
(Semi-)autonomous vehicles and persuasive interfaces, interface evaluation (Usability and User Experience), definitions and formal approaches in HCI, in-vehicle UIs, theories of consciousness
Background
Tutorial Goals

• At the End of this tutorial you will
  • Know the basic requirements and elements of a pattern
Tutorial Goals

• At the End of this tutorial you will
  • Know the basic **requirements** and **elements** of a pattern
  • Be able to correctly **formulate problem statements** as the basis of a pattern
Tutorial Goals

• At the End of this tutorial you will
  • Know the basic **requirements** and **elements** of a pattern
  • Be able to correctly **formulate problem statements** as the basis of a pattern
  • Be able to **write** a pattern from scratch for solutions from your respective area, domain, or discipline
Tutorial Goals

• At the End of this tutorial you will
  - Know the basic **requirements** and **elements** of a pattern
  - Be able to correctly **formulate problem statements** as the basis of a pattern
  - Be able to **write** a pattern from scratch for solutions from your respective area, domain, or discipline
  - Have access to a **rating scale** for pattern elements to help with the iteration process
Tutorial Structure

• **Introduction**
• **Pattern Theory**
  • What is a pattern, basic elements of a pattern and their requirements
• **Hands-on: Problem statements**
  • Write and iterate on an appropriate problem statement from your area
  • Briefly present the statement and iterate based on feedback
• **Break**
• **Hands-on: Pattern Writing – Context & Solution**
  • Write a complete pattern based on the problem statement from before
• **Hands-on: Pattern Iteration**
  • Read everyone else’s pattern and rate them with the standardized rating sheet
  • Iterate your own pattern based on the ratings you received
• **Presentation**
  • Present your pattern in plenum, explain the contents of each subcategory (what&why) and where&why parts were iterated
• **Closing and Open Discussion**
Introduction and Pattern Theory

• Patterns – What are they?
  • What they are: Structured and documented solutions to reoccurring problems.
Introduction and Pattern Theory

- **Patterns – What are they?**
  - **What they are:** Structured and documented solutions to reoccurring problems.
  - **What they can be:** Knowledge transfer method within and between disciplines and areas.
Types of Patterns

Regular Patterns

• Describe proven solutions to reoccurring problems
Types of Patterns

Regular Patterns
• Describe proven solutions to reoccurring problems

Anti-Patterns
• Describe solutions, which are proven not to work to solve reoccurring problems
Types of Patterns

Regular Patterns
• Describe proven solutions to reoccurring problems

Anti-Patterns
• Describe solutions, which are proven not to work to solve reoccurring problems

Dark Patterns
• Describe design solutions designed to trick users or in any way crafted with malicious intent
Types of Patterns

Regular Patterns
• Describe proven solutions to reoccurring problems

Anti-Patterns
• Describe solutions, which are proven not to work to solve reoccurring problems

Dark Patterns
• Describe design solutions designed to trick users or in any way crafted with malicious intent
Introduction and Pattern Theory

• Example – a Programming Pattern

http://gameprogrammingpatterns.com/observer.html
Example – and HCI Design Pattern

Card Stack

What: Put sections of content onto separate panels or "cards," and stack them up so only one is visible at a time; use tabs or other devices to give users access to them.

Use when: There's too much material on the page. A lot of controls or texts are spread across the UI, without benefit of a very rigid structure (like a Property Sheet); the user's attention becomes distracted. You can group the content into Titled Sections, but they would be too big to fit on the page all at once. Finally -- and this is important -- users don't need to see more than one section at a time.

Why: The labeled "cards" structure the content into easily-digestible chunks, each of which is now understandable at a glance. Also, tabs, the most common form of Card Stack, are very familiar to users.

How: First, get the information architecture right. Split the content into coherent chunks, and give them short, memorable titles (one or two words, if possible). Remember that if you split the content up wrong, users must switch back and forth between cards as they enter information or compare things. Be kind to your users and test the way you've organized it.

Then choose a presentation:

- Tabs are great, but they usually require 6 or fewer cards. Don't "double-row" them, since double rowing is almost never easy to use; scroll them horizontally if they won't fit in one row all at once.

* © Jennifer Tidwell; [http://designinginterfaces.com/firstedition](http://designinginterfaces.com/firstedition); retrieved 2014
Pattern Requirements

- **a) Findability:** A pattern needs to be easily findable within a pattern collection or language. If it already requires considerable effort to find a pattern in the first place, then that defeats the aim of patterns to provide easier access to specific information.
Pattern Requirements

• **a) Findability:** A pattern needs to be easily findable within a pattern collection or language. If it already requires considerable effort to find a pattern in the first place, then that defeats the aim of patterns to provide easier access to specific information.

• **b) Understandability:** The described solution must be understood by its users. A solution, which is not understood, can hardly be implemented correctly (or at all).
Pattern Requirements

• **a) Findability:** A pattern needs to be easily findable within a pattern collection or language. If it already requires considerable effort to find a pattern in the first place, then that defeats the aim of patterns to provide easier access to specific information.

• **b) Understandability:** The described solution must be understood by its users. A solution, which is not understood, can hardly be implemented correctly (or at all).

• **c) Helpfulness:** The described solution must be feasibly realizable within the reader’s available resources. It must furthermore contain enough information, so that the reader can realize the solution in practice.
Pattern Requirements

• **a) Findability**: A pattern needs to be easily findable within a pattern collection or language. If it already requires considerable effort to find a pattern in the first place, then that defeats the aim of patterns to provide easier access to specific information.

• **b) Understandability**: The described solution must be understood by its users. A solution, which is not understood, can hardly be implemented correctly (or at all).

• **c) Helpfulness**: The described solution must be feasibly realizable within the reader’s available resources. It must furthermore contain enough information, so that the reader can realize the solution in practice.

• **d) Empirical Verification**: The pattern solution should be supported by empirical data. A solution supported by empirical data is of higher quality than one, which is based only on individual experiences and/or observations.
Pattern Requirements

- **a) Findability:** A pattern needs to be easily findable within a pattern collection or language. If it already requires considerable effort to find a pattern in the first place, then that defeats the aim of patterns to provide easier access to specific information.

- **b) Understandability:** The described solution must be understood by its users. A solution, which is not understood, can hardly be implemented correctly (or at all).

- **c) Helpfulness:** The described solution must be feasibly realizable within the reader’s available resources. It must furthermore contain enough information, so that the reader can realize the solution in practice.

- **d) Empirical Verification:** The pattern solution should be supported by empirical data. A solution supported by empirical data is of higher quality than one, which is based only on individual experiences and/or observations.

- **e) Overall acceptability:** This is an additional criterion to capture the subjective component of whether or not a reader agrees with a pattern solution or not, regardless of the presence or absence of deficiencies in any of the other quality requirement categories.
Minimal Pattern Elements

- **a) Means of reference:** Name, Type, Keywords, and similar elements serve to distinguish a solution description from others, help build references between solutions, which are dependent on other solutions or problems, and aid in finding or re-finding the particular solution in a collection or database containing several patterns. Corresponds to the criterion of findability. At least one such means of finding and reference should be contained in every pattern.
Minimal Pattern Elements

- **a) Means of reference:** Name, Type, Keywords, and similar elements serve to distinguish a solution description from others, help build references between solutions, which are dependent on other solutions or problems, and aid in finding or re-finding the particular solution in a collection or database containing several patterns. Corresponds to the criterion of findability. At least one such means of finding and reference should be contained in every pattern.

- **b) Problem description:** Patterns are not general guidance documents but always targeted at a specific problem. This problem must be described or explicitly mentioned at least briefly, to let the reader decide whether the pattern is of use in the particular case or not.
Minimal Pattern Elements

• **a) Means of reference:** Name, Type, Keywords, and similar elements serve to distinguish a solution description from others, help build references between solutions, which are dependent on other solutions or problems, and aid in finding or re-finding the particular solution in a collection or database containing several patterns. Corresponds to the criterion of findability. At least one such means of finding and reference should be contained in every pattern.

• **b) Problem description:** Patterns are not general guidance documents but always targeted at a specific problem. This problem must be described or explicitly mentioned at least briefly, to let the reader decide whether the pattern is of use in the particular case or not.

• **c) Context description:** Since patterns provide solutions for very concrete problems, these problems need to be described in the context the solution occurred in. Depending on the context, some solutions are not feasible or have different effects than they would have in other contexts. Ideally, this context description includes a detailed listing of the forces influencing the solution, but not necessarily. The basic requirement is a description detailed enough to let the reader decide whether the solution can be applied in the particular context or not.
• **Solution description:** The solution is arguably the most important part of a pattern. It must be described, not merely mentioned, ideally from the identification to the problem to the fully working implementation of the solution in a step-by-step manner.
Minimal Pattern Elements

• **d) Solution description:** The solution is arguably the most important part of a pattern. It must be described, not merely mentioned, ideally from the identification to the problem to the fully working implementation of the solution in a step-by-step manner.

• **e) At least one example:** In order to satisfy the general requirement of giving practical guidance, the pattern should contain at least a description of one case of a successful solution implementation.
Minimal Pattern Elements

• **a) Means of reference:** Name, Type, Keywords, and similar elements serve to distinguish a solution description from others, help build references between solutions, which are dependent on other solutions or problems, and aid in finding or re-finding the particular solution in a collection or database containing several patterns. Corresponds to the criterion of findability. At least one such means of finding and reference should be contained in every pattern.

• **b) Problem description:** Patterns are not general guidance documents but always targeted at a specific problem. This problem must be described or explicitly mentioned at least briefly, to let the reader decide whether the pattern is of use in the particular case or not.

• **c) Context description:** Since patterns provide solutions for very concrete problems, these problems need to be described in the context the solution occurred in. Depending on the context, some solutions are not feasible or have different effects than they would have in other contexts. Ideally, this context description includes a detailed listing of the forces influencing the solution, but not necessarily. The basic requirement is a description detailed enough to let the reader decide whether the solution can be applied in the particular context or not.
Problem Statement

• A good problem statement works like a good question

• A good question needs to be formulated such, so that one can state what a potential answer would need to fulfill in order to answer said question.
Problem Statement

• A good problem statement works like a good question

  • A good question needs to be formulated such, so that one can state what a potential answer would need to fulfill in order to answer said question.

  • In other words: If we don’t even know what a satisfactory answer to a question would look like, then that is not a good question.
Problem Statement

• A good problem statement works like a good question
  
  • A good question needs to be formulated such, so that one can state what a potential answer would need to fulfill in order to answer said question.
  
  • In other words: If we don’t even know what a satisfactory answer to a question would look like, then that is not a good question.
  
  • Example from Philosophy: “What is truth?”
    • Are we looking for a physical object? A language construct? A semantic function? An (abstract or physical) attribute or property?
Problem Statement

• A good problem statement works like a good question
  
  • A good problem statement is formulated such, so that one can state what a potential solution would need to fulfill in order to solve the problem.
Problem Statement - Example

Evolution of a (bad) problem statement

1) Where should what be displayed?
Problem Statement - Example

Evolution of a (bad) problem statement

1) Where should what be displayed?

2) Where should displays be positioned in the cockpit?
Problem Statement - Example

Evolution of a (bad) problem statement

1) Where should what be displayed?

2) Where should displays be positioned in the cockpit?

3) Where does a driver look first? Which areas are quicker to access for the eyes than others?
Final Problem Statement:

• Information sources are spread throughout the cockpits of cars (instrument cluster, center console, in and around the steering wheel). Differently sized displays in different positions make it difficult for the driver to locate the right information at the right time, thus being a potential source of distraction for the driver.
Finding the right Problem

Final Problem Statement:

• Information sources are spread throughout the cockpits of cars (instrument cluster, center console, in and around the steering wheel). Differently sized displays in different positions make it difficult for the driver to locate the right information at the right time, thus being a potential source of distraction for the driver.
Finding the right Problem

Final Problem Statement:

• Information sources are spread throughout the cockpits of cars (instrument cluster, center console, in and around the steering wheel). Differently sized displays in different positions make it difficult for the driver to locate the right information at the right time, thus being a potential source of distraction for the driver.

• A successful solution needs to provide information on areas (to account for the size), where displays can be positioned in the car and how long it takes to gather information from each area. The distraction potential and recommendations on information to be displayed for each respective area need to be acknowledged as well.
Hands-On: Write a Problem Statement

Keep in mind:
• It need not be important or recurring.
Hands-On: Write a Problem Statement

Keep in mind:

• It need not be important or recurring.
• It should be a problem you know the solution to
Hands-On: Write a Problem Statement

Keep in mind:

• It need not be important or recurring.
• It should be a problem you know the solution to
• It can be specific to your area of expertise or completely mundane
Hands-On: Write a Problem Statement

Keep in mind:
• It need not be important or recurring.
• It should be a problem you know the solution to.
• It can be specific to your area of expertise or completely mundane.

Examples/Primers:
• You want to open a bottle but have no bottle opener.
• You need to take notes but have neither pen nor paper.
Minimal Pattern Elements

• a) Means of reference: Name, Type, Keywords, and similar elements serve to distinguish a solution description from others, help build references between solutions, which are dependent on other solutions or problems, and aid in finding or re-finding the particular solution in a collection or database containing several patterns. Corresponds to the criterion of findability. At least one such means of finding and reference should be contained in every pattern.

• b) Problem description: Patterns are not general guidance documents but always targeted at a specific problem. This problem must be described or explicitly mentioned at least briefly, to let the reader decide whether the pattern is of use in the particular case or not.

• c) Context description: Since patterns provide solutions for very concrete problems, these problems need to be described in the context the solution occurred in. Depending on the context, some solutions are not feasible or have different effects than they would have in other contexts. Ideally, this context description includes a detailed listing of the forces influencing the solution, but not necessarily. The basic requirement is a description detailed enough to let the reader decide whether the solution can be applied in the particular context or not.
Context Description

• A good context description contains
  • All factors relevant to allow the reader to decide whether or not the solution is (re-)applicable in a different or similar context.
Context Description

- A good context description contains
  - All factors relevant to allow the reader to decide whether or not the solution is (re-)applicable in a different or similar context
  - Tools/methods at one’s disposal to achieve a solution
Context Description

• A good context description contains
  • All factors relevant to allow the reader to decide whether or not the solution is (re-)applicable in a different or similar context
  • Tools/methods at one’s disposal to achieve a solution
  • Constraints, which make certain approaches impossible, unfeasible or inefficient
Context Description

• **A good context description contains**
  
  • All factors relevant to allow the reader to decide whether or not the solution is (re-)applicable in a different or similar context
  
  • Tools/methods at one’s disposal to achieve a solution
  
  • Constraints, which make certain approaches impossible, unfeasible or inefficient

• **Analogy to Linguistics:**
  
  • “The window is open.” – The context decides, whether or not this is a descriptive statement or an imperative.
Context Description

- **A good context description contains**
  - All factors relevant to allow the reader to decide whether or not the solution is (re-)applicable in a different or similar context
  - Tools/methods at one’s disposal to achieve a solution
  - Constraints, which make certain approaches impossible, unfeasible or inefficient

- **Analogy to Linguistics:**
  - “The window is open.” – The context decides, whether or not this is a descriptive statement or an imperative.

- The context description enriches the information contained in the Problem statement and provides guidance as well as constraints for the Solution description
Hands-On: Write down the Problem Context

Keep in mind:
• What do I have available
Hands-On: Write down the Problem Context

Keep in mind:
• What do I have available
• What are my constraints (What can’t I do?)
Hands-On: Write down the Problem Context

Keep in mind:
• What do I have available
• What are my constraints (What can’t I do?)
• What other factors might influence the problem or solution? What makes certain things work particularly well or the opposite
Hands-On: Write down the Problem Context

Keep in mind:
• What do I have available
• What are my constraints (What can’t I do?)
• What other factors might influence the problem or solution? What makes certain things work particularly well or the opposite

Examples/Primers:
• You want to open a bottle but have no bottle opener
  • Context decides what else you have available to you
• You need to take notes but have neither pen nor paper
  • See above
Minimal Pattern Elements

• **d) Solution description:** The solution is arguably the most important part of a pattern. It must be described, not merely mentioned, ideally from the identification to the problem to the fully working implementation of the solution in a step-by-step manner.

• **e) At least one example:** In order to satisfy the general requirement of giving practical guidance, the pattern should contain at least a description of one case of a successful solution implementation.
The Solution

- Is a step-by-step guidance through the whole process
The Solution

• Is a step-by-step guidance through the whole process
• Starts at the identification of the problem, ends at the working implementation.
The Solution

• Is a step-by-step guidance through the whole process
• Starts at the identification of the problem, ends at the working implementation.
• Needs to address every single aspect included in the Problem statement
The Solution

- Is a step-by-step guidance through the whole process
- Starts at the identification of the problem, ends at the working implementation.
- Needs to address every single aspect included in the Problem statement
- Needs to address beneficial factors and limitations from the context description
The Solution

• Is a step-by-step guidance through the whole process

• Starts at the identification of the problem, ends at the working implementation.

• Needs to address every single aspect included in the Problem statement

• Needs to address beneficial factors and limitations from the context description

• This is why the Problem Statement and Context are so Important: They Problem statement guides the Solution writing Process!
Hands-On: Write down the Solution

Keep in mind:
• Don’t only mention, describe.
Hands-On: Write down the Solution

Keep in mind:

• Don’t only mention, describe.
• Do not write for experts, do not write for yourself. Write for every potentially interested individual.
Hands-On: Write down the Solution

Keep in mind:
• Don’t only mention, describe.
• Do not write for experts, do not write for yourself. Write for every potentially interested individual.
• Ask yourself “Does this fully address the problem statement or are there still unaddressed aspects”.
Hands-On: Write down the Solution

Keep in mind:

• Don’t only mention, describe.
• Do not write for experts, do not write for yourself. Write for every potentially interested individual.
• Ask yourself “Does this fully address the problem statement or are there still unaddressed aspects”.
• Include trivial steps and common knowledge
Hands-On: Write down the Solution

Keep in mind:
• Don’t only mention, describe.
• Do not write for experts, do not write for yourself. Write for every potentially interested individual.
• Ask yourself “Does this fully address the problem statement or are there still unaddressed aspects”.
• Include trivial steps and common knowledge
• Think of it as Solution Writing for Dummies
Hands-On: Add descriptive Name or Keywords and one example

Name:

- Should allow a first-pass decision on whether or not problem/solution are relevant for the reader.
- Should ideally give hints to problem area and context
Hands-On: Add descriptive Name or Keywords and one example

Name:
• Should allow a first-pass decision on whether or not problem/solution are relevant for the reader.
• Should ideally give hints to problem area and context

Keywords:
• Provide information on domain, context, stakeholders, technology involved
• Allow referencing with related patterns or literature/documentation/guidance.
Hands-On: Add descriptive Name or Keywords and one example

Name:
• Should allow a first-pass decision on whether or not problem/solution are relevant for the reader.
• Should ideally give hints to problem area and context

Keywords:
• Provide information on domain, context, stakeholders, technology involved
• Allow referencing with related patterns or literature/documentation/guidance.

Example:
• Images say more than words
• The more examples, the better
The Iteration process

• Writing a complete pattern requires time and several iterations
The Iteration process

- Writing a complete pattern requires time and several iterations

- Ideally, this is done via writers’ workshops, in which patterns of various stages of maturity are read and discussed together with others
The Iteration process

• Writing a complete pattern requires time and several iterations

• Ideally, this is done via writers’ workshops, in which patterns of various stages of maturity are read and discussed together with others

• Rating systems can facilitate this process
  • Rate the pattern in each of its subcategories and general pattern requirements.
  • Low individual scores imply weaknesses in the respective Pattern-subsection. This allows for focused iterations.
  • The pattern is finished (barring minor polishing), if it receives high ratings (4+ on a 5-point scale) for each item.
Iteration Process Example

1st Iteration Workshop

2nd Iteration Workshop

Validation

Final Iteration

Final Pattern

Initial Pattern Mining & First Iteration

Second Iteration

Pattern Introduction & Knowledge Transfer

Academia & Industry

Academia & Industry

Academia & Industry

Academia

Academia

Academia

Image © 2016 Thomas Grah, Center for HCI, University of Salzburg
Hands-On: Read and Rate everyone else‘s Patterns

- Use the provided rating sheets.
- Read the pattern carefully from beginning to end.
- The more individuals read and rate a pattern, the better.
- Each pattern subsection is rated regarding its quality on a 5-point scale.
- If a subsection receives an (avg.) rating <4, then the pattern needs to be iterated for that subsection only.
- Iterations continue until scores >4 for each subsection as well as for the overall rating are reached.
- *(We are only doing one iteration cycle in this exercise, however)*
Discussion, Q&A
Contact

Mag. Alexander G. Mirnig
Center for Human-Computer Interaction
University of Salzburg

Jakob-Haringer-Straße 8 /Techno 5
5020 Salzburg

+43 662 8044/4844
alexander.mirnig@sbg.ac.at