Learning from an Extended Context of Patterns in *Science of Design*

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Abstract
In this position paper, we present our interdisciplinary approach to patterns and pattern languages in HCI-design. In the past, we have introduced ideas, foundations and a conceptual framework [4], [5] of a descriptive pattern language based on Gestalt theory [13], visual language [8], and semiotics. As an ideal final result, our research project intends to reduce the cognitive workload during human-computer interaction (HCI) by exploring intuitive user interfaces. Basically, we try to achieve this goal through an interdisciplinary knowledge transfer by means of pattern methodology.

Keywords
HCI, Gestalt psychology, art, visual language, patterns, knowledge transfer.

ACM Classification Keywords
H5.2. Information interfaces and presentation: User interfaces – theory and methods; user-centered design.

Introduction
Context can be regarded as the large family of meanings and valuations, which is the basis for conscious evaluations. Human perception as well as cognition seems to be founded upon the existing (perceptual) knowledge in a particular context. During

Definition of Pattern [1]

1. A model or an original used as an archetype. A thing considered worthy of imitation.

2. A plan, diagram, or model to be followed in making things: *a dress pattern.*

3. A representative sample.

4. An artistic or decorative design: *a paisley pattern.*

5. A consistent, characteristic form, style, or method, as: A composite of traits or features characteristic of an individual or a group: *one's pattern of behavior.*

6. Form and style in an artistic work or body of artistic works.

Thesaurus: A systematic arrangement or design: pattern, organization, method, order, orderliness, plan, system, composition, ordering, grouping, arrangement, scheme.

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human-computer interaction (HCI), top-down processing is based upon a prior knowledge of the world. This knowledge-driven perception involves the notion that our preexisting concepts, knowledge, ideas, and anticipations influence the way a stimulus is interpreted. Knowledge presented at higher levels and intellectual abilities determine what is perceived. Since learning is based on the strengthening of associations, ideas that do not connect to existing learning simply cannot be learnt [8]. When designing interactive software components, the users' cognitive processes as well as their cognitive limitations must be taken into account. As a result, the nature and causes of the problems users encounter need to be identified and explained. We believe that this could be done best by patterns and pattern languages. Within our pattern language framework, we discuss effects of Gestalt principles and visual language components comprehensively. For the authors it is important not just to focus on questions of *how,* artifacts of implementations or even idioms, but rather on philosophical questions, concentrating on *why*. Within the examples section, we discuss examples from different domains, predominantly from art [6]. Thereby, we foster a convergence of science and art.

Visual Language History

First attempts of visual language as a matter of design can be found with artists. KLEE [12] and KANDINSKY [10] tried to identify an abstract and universal grammar of visual expression. KLEE'S grammar of elements involves a metaphor between visual and verbal form: the relationship between point, line, and plane is compared to active and passive "voice" in language. Later, two books by KEPES [11] and MOHOLY-NAGY [14] elaborated the theory of visual language and gave it a scientific rationale. Influenced by the Bauhaus and by Gestalt theory, KEPES'S work, for example, verifies and expands on the notion of an autonomous faculty of visual communication. His studies also included psychological phenomena, such as figure-to-ground relationship, consequences of similarity, closure, inclusiveness, and submergence. HORN [8] described visual language as *"the tight integration of words and visual elements and as having characteristics that distinguish it from natural languages as a separate communication tool as well as a distinctive subject of research".* In his analysis of the properties of visual language, he uses well-established categories of linguistics: *morphology*, *syntax*, *semantics*, and *pragmatics*. Morphology involves a set of basic elements, syntax establishes rules for combining these elements, semantics is concerned with the meaning of combined elements, and the actual use of elements for specific communicative purposes is defined by pragmatics. Their integration creates visual language. When visual language, Gestalt principles, and pattern mining are interlinked, in our opinion something new, which is able to increase our human knowledge, can be created.

Motivation: The Change of Views on Patterns

Christopher Alexander is regarded as the founder of patterns and pattern languages [1], [2]. He attempted to combine the *scientific* worldview with an adequate view of *art* and *architecture* [2]. Parts of the software engineering community have enthusiastically embraced his pattern concept, amongst others, due to the book [7]. These patterns of object-oriented software provide design solutions that are concrete enough to put them immediately into practice, limited only by the imagination and skill of the pattern user. However, in the field of human-computer interaction, the

> "*The world changes in relation to our interfaces with it. The limits of the world are the limits of our interface. We do not interact with the reality of the world, we do so with its interface*".
>
> (Peter Weibel [17])

community's understanding of this technology-oriented design pattern concept and its application in HCI has undergone some changes throughout this period. TIDWELL [16] pulled the work of Gamma et al. and their fellows to pieces arguing "*we badly need the benefits of such a pattern language in the field of HCI design*". One reason for this clash might be that in HCI good design is the key to success, not good programming. According to [15], resistance comes often from technology enthusiasts who rate mathematical or technical formalism as more important than psychological experimentation. As a result, arguments in favor of a user-centered approach are far too often neglected. This seems to be a universal problem that leads to the characteristics of our two brain hemispheres, right and left, characterized by many specialized functions. With our work, we aim to convey knowledge between disciplines, symbolically speaking between the brain hemispheres. In the following enumeration by [3], not yet complete, we give examples. The first feature mentioned of each pair is attributed to the right and the second one to the left brain hemisphere:

- Separations of *emotions* and *rationality*
- *Artistic abilities* and *logical thinking*
- *Holistic* and *detail-oriented* approaches
- Sensitivity to *sets* or *sequences*
- Perception of *whole melodies* or *separate notes*
- Affection to *manual creativity* or *verbal expression*
- *Spatial* and *temporal* perception

Pattern Framework Outline

In science, the moment of truth comes when theory confronts experimental evidence. Starting with the generic or high-level pattern *Gestalt whole-parts*, we discuss the elusive and philosophical challenge of our work. We formulated the pattern in the context of systems thinking. A good *whole,* a metaphor taken from Gestalt theory, is characterized by the quality of Prägnanz or simplicity. An appropriate translation might be "easy to memorize". In addition, we describe why and under which limitations Prägnanz can be perceived. Associated with the idea of "the whole" is a principle called *emergence*: The mutual interaction of a system's parts results in new characteristic features, which cannot be found as original characteristics of any of the individual parts. When a system is dissected, either physically or theoretically, its complexity on a higher system level gets destroyed.

At the next level of abstraction we have established the patterns *Gestalt Prägnanz*, *Gestalt figure-ground*, *Gestalt focal point* and *Gestalt isomorphic correspondence*. Because of their ability to express semantics, we assign the linguistic category *semantics* to these patterns. Moreover, the integration of verbal and visual elements is accomplished at this level. The key question of the pattern *Gestalt Prägnanz*, for example, is how to organize morphemes of a visual language to achieve "good form" or Prägnanz? The forces occurring are ranging from perceptual factors, the capacity of our brain, the quality of visual elements, to usability concerns, and semantic aspects. The underlying Gestalt principles contribute as elementary units to the overall goodness of perceptual grouping respectively figure-ground segregation.

Thumbnail of a Single Pattern

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Gestalt Principles Involved

The discussed Gestalt principles of perceptual grouping (similarity, proximity, good continuation, closure, and symmetry) as well the segregation factors surroundedness and area state the essential findings of Gestalt psychologists in our pattern language. Through different sections, we discuss the consequences of applying these Gestalt principles. As we believe, these principles correspond to the category syntax in visual language. Finally, let us have a closer look at the Gestalt principle symmetry or balance, which is one of the basic Gestalt principles: Morphological elements and Gestalt phenomena show signs of symmetry and a lack of symmetry at the same time. While a thing is symmetric in one or more aspects, it is asymmetric in others. On the one hand, there is no perfect symmetry in the sense that all properties are preserved; on the other hand, there neither is perfect asymmetry in the sense that no property is preserved. A very symmetric scene might be boring; a very asymmetric scene would be ugly.

References

[1] Alexander, C., Ishikawa, S., and Silverstein, M. *A Pattern Language*. Oxford University Press, 1977.

[2] Alexander, C. An Open Letter to the Melilla Conference Participants. *Leonardo* 39, 1 (2006), 76.

[3] Darvas, G. *Symmetry and Asymmetry in Our Surroundings. Aspects of Symmetry in the Phenomenon of Nature, Physical Laws, and Human Perception.* In Weibel, P. (ed.), *Surroundings Surrounded – Essays on Space and Science*. ZKM (2000), 136-149.

[4] Flieder, K. *Prägnanz in HCI-Design: Towards a Pattern Language*. In Holzinger, A., and Weidmann K.-H. (eds.), *Empowering Software Quality: How can Usability Engineering reach these Goals*? OCG (2005), 69-77.

[5] Flieder, K., and Mödritscher, F. Foundations of a Pattern Language based on Gestalt Principles. *Ext. Abstracts CHI 2006*, ACM Press (2006), 773-778.

[6] Flieder, K. Figure & Ground: An Interdisciplinary Approach to Patterns in HCI-design. *Ext. Abstract, submitted to CHI 2007*.

[7] Gamma, E., Helm, R., Johnson, R., Vlissides, J., and Booch, G. *Design Patterns: Elements of Reusable Object-Oriented Software*. Addison-Wesley, 1995.

[8] Heylighen, F. Objective, Subjective and Intersubjective Selectors of Knowledge. *Evolution and Cognition* 3, 1 (1997).

[9] Horn, R.E. *Visual Language: Global Communication for the 21st Century*. Macro VU, 1998.

[10] Kandinsky, W. *Point and Line to Plane*. Dover Publications, New York, 1979.

[11] Kepes, G. *Language of Vision*. Paul Theobald & Company, Chicago, 1944.

[12] Klee, P. *Pedagogical Sketchbook*. Faber & Faber, Boston, 1968. (Original work published in 1924).

[13] Koffka, K. *Principles of Gestalt Psychology*. Harcourt, Brace and World, New York, 1935.

[14] Moholy-Nagy, L. *Vision in Motion*. Paul Theobald & Company, Chicago, 1947.

[15] Shneiderman, B. *Leonardo's Laptop: Human Needs and the New Computing Technologies*. MIT 2002.

[16] Tidwell, J. *Common Ground: A Pattern Language for Human-Computer Interface Design*. (2007-01-01) http://www.mit.edu/~jtidwell/ui_patterns_essay.html

[17] Weibel, P. Over and Beyond the Limits of Reality. Lecture held at *Ars Electronica 92*, Linz, Austria.