Languages, visuals, design, and creativity

Recently, I had the fortune of observing one of the last Italian plasterers (stuccatore) that still is a master of the traditional techniques once used for wall decorations in Renaissance and Baroque churches and palaces. The process is rather complex, and requires a good deal of practical ability and expertise. Basically, it all starts from a flat drawing of what will appear on the wall: leaves, fruits, decorations. That drawing can be done on paper and then transposed to the wall surface with a cartone, as is done for frescoes, or it can be sketched directly on the wall. It guides the placement of the first layer of matter (intonaco) that will then support and give shape to the white plaster, which is made of marble powder. The drawing guides the artist, but it is not a constraint: modeling volumes, he is free to reduce the leaves, or to introduce a new element that will give more balance to the whole piece. It is a project idea, which will acquire concreteness, step by step, and will eventually change, in order to become what it was supposed to be in the artist’s mind.

Sitting on a train, drafting this preface, I enjoy taking my eyes off of the laptop screen and contemplating the people in the compartment, what they do, and their environment. We are literally submerged with pictures and visual representations: newspapers and magazines are, more and more, a collection of pictures accompanied by text; signs on the walls of the compartment use color codes and icons to remind passengers that smoking is not allowed, or that the toilet is available, or occupied or, worse, out of order. The same happens with our mobile phones, and even more with computers. We live with pictures, we think in pictures, we often express ourselves in pictures, often complementing or integrating the visuals with verbal language.

This is true of everyday life, but also in many fields of professional life, and especially, as chapter 1.1 will claim, of knowledge work. Visuals support imagination, and therefore also support creative thinking. We imagine things in our minds, we represent them, and this allows us to re-think them, and improve our plans. We are used to that—both those who have a better hand at drawing and those who do not—so used that we are often not aware of it, and do not invest in improving that skill. Some professional fields, especially creative ones, capitalized on the power of visualizations, and developed specific design languages. This is true of course of architecture, but also of electronics or mathematics, or of fashion design and Web design.

A basic tenet of this handbook is that instructional design is a creative profession, and can benefit from the application and use of design languages in a number of ways. The first goal of the handbook is to raise awareness of this opportunity, and to demonstrate the available results of research in this field.

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Imagine an engineer in charge of designing a new bike. It has to be light and durable, and for this reason he will use a new, rather expensive metal. It has also to be aerodynamic, and this means following some constraints in designing its shape. He will sketch it, probably several times, before finding the right gist of a solution, which will then be moved into a CAD program, where the drawing, digitized, will be developed into a detailed plan, taking metal resilience, aesthetics, mechanics, etc., into consideration. As the design progresses, the drawing will be split into parts, and specialists will deal then with details: brakes, gears, etc. After the production, the engineer himself may supervise the final assembly of the prototype bike, guided by an overview diagram.

Within a creative process, we seamlessly move in and out of different design languages and visualizations, according to the needs of the process. Each phase, often each person in a design team, has specific needs, and a specific language to fulfill them. This specific language must be recognized to maximize his/her effectiveness. As in the example of the engineer above, the same happens in instructional design, where interdisciplinary teams are at work. This handbook therefore collects a number of visual instructional design languages, presents them to the reader and, tentatively, provides a comparative view on some of them. The point is not selecting the best one, rather to identify the most adequate to a specific situation, or the mix of them that can support a specific process.

CLASSIFICATION FRAMEWORK

In order to facilitate the understanding and comparison of the different visual design languages presented in the handbook, we asked the authors of chapters in section II to refer to a shared framework, originally published in Botturi, Derntl, Boot, and Figl (2006).

The idea behind that framework is that different design language features address different ways of thinking: a highly formal language like UML fits the way of thinking of a more accurate and technically-oriented person better, while rather sketchy, informal languages are more suitable for creative and intuitive mindsets.

It is comprised of five features, namely:

1. **Stratification**: (nominal: flat, layered) A layered language offers a set of tools or representations for describing entities of different types, such as people and roles, activities, or learning materials. On the other hand, a flat language would collect entities of all types into a single representation. For example, UML takes a layered perspective.

2. **Formalization**: (interval: formal, informal) A formal language defines a stringent, closed set of concepts and rules for composition of concepts in order to describe designs. For instance, XML or UML are formal languages, while sketches or dialogs are more open and informal. Other design languages may combine formal and informal descriptions.

3. **Elaboration**: (ordinal: conceptual, specification, implementation) Each particular design language is able to provide more or less detail of a specific artifact. The three levels of elaboration are taken from Fowler (2003): The conceptual level allows for a general, aggregate view on the design, indicating its rationale and main elements; the specification level provides means for a more comprehensive description, including all elements; the implementation level represents the highest level of detail achieving maximum precision.
4. **Perspective**: (nominal: *single, multiple*) While layered languages foresee the use of multiple representations for different entities, multiple-perspective languages exploit different tools for representing more than one view on the same entities. For example, E²ML offers two overview diagrams, one for chronological relationships among learning activities, and one for structural relationships.

5. **Notation System**: (nominal: *none, textual, visual*) If a language exposes a notation system, this can be primarily non-visual (=textual, e.g., IMS/LD) or visual (e.g., UML).

The original paper proposed a tentative classification of some major design languages, which is extended and enriched here. Also, the paper contained a bi-dimensional classification of possible uses of visual instructional design languages, considering that each design language was developed with a specific use framework in mind. The two dimensions are:

1. **Communication**: The first axis in the application framework concerns the main objective of the ID language, with two values: (a) *Reflective* (personal) means that the language is used primarily for personal creative thinking. This is useful for formally-bent or visually-oriented people and for designers in the first conceptual stages of design in which they do not yet collaborate with other designers and stakeholders; (b) *Communicative* (community) indicates that the language is used to communicate with other designers or stakeholders. This is useful for interdisciplinary design teams involving different views/roles.

2. **Creativity**: The second axis describes the relationship between the design language and the generation of design solutions: (a) *Generative* means that the language can be used as a means of exploring the design space and creating and refining design solutions and alternatives, e.g., during redesign. (b) *Finalist* means that it is used to formalize and “freeze” the final design solution, e.g., for creating a final IMS/LD specification of an e-learning module.

We asked authors to describe their languages according to this reference framework, and also to indicate their main type of use. Note that a single design language need not to be located on a single spot, but may occupy a range on an axis or an area in the classification box, respectively. For example, most languages can be used for reflective and communicative purposes.

**HANDBOOK STRUCTURE**

The handbook is structured in three sections. Section I contains foundational chapters and chapters regarding theory behind visual instructional design languages. Section II contains examples of visual languages, and section III contains research regarding the use of VIDLs.

**Section I: Foundations and Theory** contains chapters that explore the underlying reasons behind visual languages for instructional design. This section will explore their value and importance to the instructional design process—with appropriate reference to design fields which traditionally rely more on visual design languages such as architecture and software design. With this background of design languages for instructional design, we will be able to answer important questions, such as ‘Why are they useful?’ and ‘When do they come into play in the practice of design?’ The ideal path moves from the idea that instructional design is a multiform knowledge work, through the idea of communication, visuals, and culture, and then back to the somewhat “old” idea of sketching on paper.
• **Chapter I** proposes a cultural transfer, throwing in ID some potentially explosive elements taken from ancient Roman architectural theory. The authors’ goal is to have readers reflect on their practice and on their approach and values as instructional designers. This actually opens up to new perspectives in selecting and applying any kind of design tool—methods, media, software applications and, of course, design languages. Ideally, this chapter pairs with chapter VI, where aesthetics again comes to play a central role.

• **Chapter II** emphasizes the need for clear and effective communication among all stakeholders interested in a design’s success, clearly calling for shared, understandable and usable design languages that can enhance communication. This provides an important double perspective to the whole handbook. On the one hand, there are many (visual) ID languages—some are included here, but others are available and being used in the world. On the other hand, such languages live, make sense and must interact with other non-specific languages, and even natural languages, the whole point being achieving more effective communication not only among designers, but also with stakeholders. Several references in the text indicate connections to other chapters in the handbook.

• **Chapter III** is a survey of the literature of design studies (which covers architecture, industrial design and other design fields) regarding the phenomenon called design drawing. In this review, the roles and attributes that design drawing plays in those fields outside of ID suggest important ways in which design drawing might contribute to the practice of ID. Important attributes such as the stages in which designs and their accompanying drawings grow, the value of vagueness in early drawings, and the ways in which drawings focus commitment to designs are covered in this chapter.

• **Chapter IV** adds another, perhaps broader, dimension to the discussion about the use of language and visuals in ID: culture. Indeed, “all designs are based in culture”, and also, all languages and visual languages come from and are understandable within a culture. This is highly relevant for designers, who should consider both stakeholders’ and learners’ cultures. The culture based model presented in the chapter is a practical tool by which to integrate such considerations in the design practice.

• **Chapter V** focuses on paper and pencil as the simplest medium to collect and convey design ideas. While we live in a world of digital images, the author reminds us that the point is not creating visuals, but rather empowering the human element of design, and that the choice of media should correspond to that. He suggests that often less technology means more creativity. Also, this chapter explains in detail what we mean by “generative” design languages, which are here called “sketching as visual thinking,” emphasising that we do not need (only) closed set of design terms and symbols, but rather the ability to draw to enhance our designs.

**Section II: Visual Instructional Design Languages** contains a sampling of visual design languages for instructional design, which are presented and illustrated by examples. The goal of this section is to provide exposure and guidance to interested practitioners who personally want to try out new tools for their instructional design projects. These VIDLs are ideally sequenced from less formal to most formal—with the understanding that specific applications may vary greatly in degree of formality.

• **Chapter VI** returns to the idea of aesthetics, broadening the definition and the scope of impact as presented in Chapter I. It draws from the concept of aesthetic experience to offer a novel, narrative-based VIDL, which can provide a new perspective for instructional designers, using narrative briefs and user profiles to develop structured design tools.
• **Chapter VII** presents the educational environments modeling language—E²ML, a simple visual language that supports structured paper-and-pencil sketches to enhance communication within the design team. E²ML was developed to provide documentation of a design and to provide a means of analysis and evaluation of the instruction itself. It, like many of the VIDLs in this book, is based loosely on a few UML representation types. E²ML comes in two versions or levels: a core version which is less formal and more focused on visual representation—more suited to the creative use; and, an advanced version which is more formal. This chapter briefly documents the former.

• **Chapter VIII** first proposes a highly structured ID method, which exploits different kinds of visualizations. Its main emphasis is on representing knowledge, i.e., the learning domain, and couples specific diagrams with specific design phases and documents. The language, MOT+, is also of particular interests as the authors have done an additional effort to make it compliant with IMS-LD specifications, enhancing interoperability. It is also the case in which a large development of a suite of tools supporting VIDL use is observable.

• **Chapter IX** belongs to a triad of chapters (IX, XII, and XIV) whose authors are working on collaborative activities—probably the most tricky and challenging issue in visually modeling learning environments. Interestingly, the three chapters take very different approaches: Chapter XIV is based on language requirements; Chapter XII on pedagogical theory; this chapter moves from the practice, constructing the language on a wide set of collected cases. This is indicative of the various natures of visual instructional design languages in general, and provides the reader with an interesting comparative outlook.

• **Chapter X** proposes a structural enhancement for IMS learning design, by splitting the language into different independent but connected concerns. It is an interesting case of formal development of a language along one dimension—layering—in order to respond to the complexity of design situations. It is interesting to follow this track through different chapters, specifically this one and Chapter XVII.

• **Chapter XI** proposes the use of UML use case diagrams as tools for performance analysis to support instructional analysis. It is interesting as it takes a specific tool developed in software engineering and repurposes it in Instructional Design, or better (and this is another merit) in the perspective of performance support, thus broadening the overall scope of the whole handbook. Also, the last part of the chapter reflects on potential pitfalls in which extremist advocates of UML—or of visual design languages in general—might fall. Along the lines of what also other authors argue, Douglas states that, “The success of modeling probably has more to do with the person doing it than with the tool itself.”

• **Chapter XII** presents LDL, an alternative instructional design language developed in order to overcome some known limitations of IMS LD in modeling online collaborative activities. As such it develops a number of connections among all chapters dealing with IMS LD, offering an interesting perspective for all of them. Interestingly, LDL is both a language, and a method that structures the design activity in order to best exploit the expressive features of the language.

• **Chapter XIII** presents CPM, a visual instructional design language specifically developed for problem-based learning. While its fundamental language concepts are original, the visual part is borrowed from UML. Also, the author provides interesting insights in the use of a formalized language by non-technically-oriented designers and teachers.

• **Chapter XIV** provides a very in-depth analysis of the continuum moving from visual instructional design languages for designers (people) to that of VIDL for automation (“system perspective”).
• **Chapter XV** focuses on IMS learning design, probably the largest effort in design languages ever in the field of distance learning and ICT. Its merit is to provide a picture of the state of the art and also to focus on tools—the link between theoretical discovery and application for many VIDL. The authors also comments on the fact that tools only cover a part of the design process, and cannot substitute, but only support, creativity.

• **Chapter XVI** provides a sort of *in vitro* experiment: we asked several authors to model a specific blended learning scenario with their languages, and to explain what are the advantages and drawbacks, and where they would come into play within the design process.

**Section III: Research Studies** contains the results of the first available studies and experiences about the use of visual instructional design languages in professional contexts.

• **Chapter XVII** viewed a sampling of the literature of ID to better understand the breadth and usage of design drawings in the theory and practice of ID. Several ID textbooks, ID journals, ID software, and case studies were sampled looking for examples of design drawing. Design drawings found were then categorized using Gibbons’ (2003) seven ID layers as a taxonomy to understand the drawings purposes. What was discovered was that, though design graphics exist, they are relatively rare and narrowly focused.

• **Chapter XVIII** provides a sort of synthetic point of view and asks a very simple yet powerful question: OK, now we have a lot of VIDLs, what do we do with them? Who should use which, in practical terms? The 3D model is both a way to solve the issue in specific cases, and a way to stimulate reflection in stakeholders’ communication.

• **Chapter XIX**. We were not sure where to place this chapter—it both presents an example of a VIDL as well as a research study providing insights about its use and value. To be certain, this chapter has one important story to tell: about a group of designers that did not want to develop a visual instructional design language, but came up with a very neat and expressive one exactly because they needed it to overcome communication barriers. The resulting language moved from “a means to an end” to “an end in itself.” This is a very valid demonstration of the opportunities a language can offer to instructional design in practice.

• **Chapter XX**. Visual instructional design languages allow the definition and expression of design patterns—design solutions that can be used over and over again for recurrent design problems (akin to Alexander’s, 1979, famed architectural patterns). This chapter is focused on patterns as a solution to the possible intricacies of actual design languages, especially of IMS learning design. Visualizations play a key role in this study, making design constructs accessible to inexperienced users and designers.

• **Chapter XXI**. The authors of this chapter argue that “very few instructional designers exist in the mainstream” of education and this is why present VIDL developments do not currently match needs of the more common users: teachers. Instead they represent where the instructional design research community would *like* mainstream teachers to be. The chapter starts by presenting a systematic analysis of current design practices in the mainstream and then goes on to illustrate this with a set of three case studies that provide a clear and challenging picture of possible research paths for encouraging the understanding and dissemination of visual instructional design languages.
ABOUT THE AUTHORS

Before leaving the floor to the actual chapters, a few words about the authors who contributed to this book.

First of all, a simple run through the biographies shows that this handbook represents a truly international perspective which reflects an added value of the handbook. This work connects research from several European countries, from Canada, the U.S., and Australia, also indicating the relevance of the topic to different research teams scattered around the globe. We regret only not having a chapter about LAMS, a large Australian and international initiative which would have deserved some pages in this handbook. This was unfortunately prevented by copyright problems.

Also, the authors of the chapters contained in the handbook belong to two different scientific communities: one oriented toward instructional design, the other stemming from learning technologies.

These “two souls” of the handbook give birth to a discourse between creativity and machine support, between free form and formalism, between communication and modeling. It is indeed enriching to see how the dialogue between these two communities developed, which will hopefully reach far beyond the pages of this handbook. Interestingly, visuals play a key role in both communities, as a sort of lingua franca and meeting point.

GENERAL ACRONYMS

During editing we noticed that many terms and acronyms recurred over and over again in the text. We consequently proposed chapter authors to skip their definitions in order to make chapters more readable. Such acronyms are explained in the following for common reference:

- **ID**: Instructional design
- **IDL**: Instructional design language
- **VIDL**: Visual instructional design language
- **LMS**: Learning management system
- **IMS LD**: IMS learning design (also **IMSLD** and **IML-LD**)
BEFORE THE READING...

As editors, we really wanted this whole handbook to be, first of all, useful to potential innovators in instructional design, learning technologies and e-learning. We really tried to make it something more than a collection of independent chapters, or a “show-off parade” of research. We tried to make it a real handbook, i.e., a book that you want to keep at hand, because it is useful.

This is why we asked authors to try to use the same reference framework, and read each other’s chapters to create meaningful connections among them. They responded generously, and we believe the result is outstanding—as a tool that we, as practitioners in the first place, more than as researchers, want to keep at hand for our daily practice. We hope this will also be the experience of other readers.

Finally, this handbook is the result of a dialogue, or better, of more dialogues. Between the editors, between editors and authors, among the authors, between two different research and professional communities—a dialogue which we hope will grow and embrace also our readers, and thus bring new ideas, tools and practices to our professional field.

Luca Botturi & S. Todd Stubbs
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REFERENCES

